INDEX TO ADVERTISERS AND CONTENTS, PAGE 44.

THE FOUNDRY

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TRADE OUTLOOK.

In December the turning point in the price of Southern iron seems to have been reached, and while for a time No. 2 foundry iron was quoted at $9 per ton (at the furnace), the price has now advanced to $9.50, and few of the furnaces are willing to take orders extending over more than the first quarter of the new year at less than $10 per ton. Many are inclined to think that the bottom has been reached and the tide has turned toward a firmer condition in the iron market. These people have not only the Southern pig iron situation as ground for this belief, but inquiries for castings and equipments seem to be coming in better, and they look for the placing of important orders after the first of the year. It is certainly to be hoped that these signs really foreshadow a turn in the situation, but at the same time it is well to remember that for the past two or three months the Northern furnaces have made practically no attempt to compete with the Southern furnacemen. After the first of the year many of the furnace companies will be able to readjust some of their costs, and by the end of the first quarter a general readjustment of cost can be looked for. This will result in placing the Northern furnaces in a position to compete with the Southern on much better terms. It is not to be expected that trade conditions will pick up so rapidly as to result in the crowded condition which has existed during the past year, but it is to be hoped that with the beginning of the year orders for castings will be placed more freely.

Wage reductions have been announced in the iron trade, effective Jan. 1, beginning at the Lake Superior Iron Mines and running through blast furnaces, steel works and rolling mill operations. In the general foundry trade it is to be expected that similar readjustment will come on the expiration of present agreements. In a few cities the new contracts with molders will be made at the end of the year, though in the large majority of foundries present agreements run into the spring months. Reports from foundry centers agree that a considerable number of molders are now idle, and there is some uncertainty about the outlook for full employment in the new year.

WRONG PLACES TO SAVE.

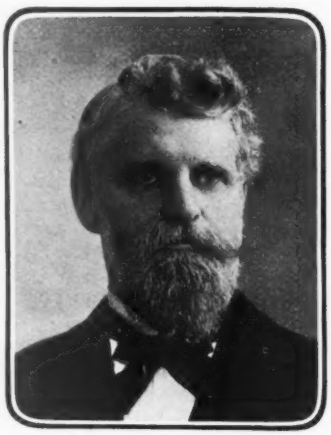
The above heading is the result of some reflections on the action of certain foundrymen in the matter of retrenchment which becomes necessary when orders are few and it is necessary to reduce the general foundry expenses. The foundryman naturally looks around to see where he can make a saving. In many cases he looks for big things rather than for little. In many foundries the chemical laboratory with its expensive chemist, is one of the latest acquisitions; the foundry has probably not gotten into full harmony with the chemist, and as a result this is the first head that gets hit. It is well to weigh the matter carefully before such a backward step is taken or at least to make sure that any experimental data which may have resulted from the chemist's work is not lost by his going.

In some cases it is undoubtedly possible for several adjoining foundries to have their work done by one chemist, but wherever experiments are being carried on for determining the

best mixtures for the work manufactured care should be taken to see that the results of these experiments are not lost. In most cases it seems as though it would be well to crowd more work of some other character on the chemist temporarily and let some one else go. Of course these problems have to be met by the management in each individual case, but we wish to call attention to the fact that it is not economy to let a man go when he takes with him the results of all the experimental work done in connection with the best mixtures necessary in the foundry, and the mere leaving of the record of the mixtures can never be as valuable an asset as to have at hand both this record and the man who understands it.

NEW PRESIDENT OF THE A. S. M. E.

At the annual meeting of the American Society of Mechanical Engineers at New York



AMBROSE SWASEY.

the first week of December the ballots for the officers were counted and it was found that Mr. Ambrose Swasey, vice president and treasurer of the Warner & Swasey Co., of Cleveland, had been elected president by a unanimous vote.

Mr. Swasey deserves well the honor which has been shown him, and it follows but a few years a similar bestowal upon Mr. W. R. Warner, of the same company.

Mr. Swasey was born at Exeter, N. H., where he attended the district school. At 18 he became an apprentice to the machinist's trade. In 1870 he entered the employ of the Pratt & Whitney Co., of Hartford, Conn. While in its employ he made a number of important inventions and improvements in the art of gear cutting. In 1880 he resigned his position with the Pratt & Whitney Co., and with Mr. Warner, who was then with the same company, came to Cleveland and established the Warner & Swasey Co. Mr. Swaseys' ability as a mechanical engineer, combined with Mr. Warner's taste for astronomical pursuits, led the firm into the manufacture of this class of apparatus, and as a result the largest telescopes of this country have been manufactured by them, together with a large amount of other optical apparatus for the Government and private parties. Mr. Swasey is past president of the Civil Engineers' Club, of Cleveland, a charter member of the American Society of Mechanical Engineers, and has the title of the Chevalier of the Legion of Honor, conferred by the French Government.

MOLD BOTTOMS.

We are glad to publish this month Mr. Thomas D. West's article on "The Bottom of a Green Sand Mold," which was read before the New England Foundrymen's Association. In this article Mr. West has certainly taken up a theme of interest to all foundrymen, and we hope that this article will stimulate others to do experimental work and carry on investigation along this line.

The foundrymen have been contented with haphazard methods altogether too long, and while we are well aware that founding is an art rather than exact science, and we know that no two men will do a piece of work exactly alike, we are, nevertheless, convinced of the fact that much can be done toward the standardization of such details as Mr. West treats in his paper, and hope we may hear from others along the same lines.

SOUTHWESTERN FOUNDRYMEN'S ASSOCIATION.

Some 20 representatives of the leading iron foundries in Kansas, Oklahoma, Indian Territory and Texas held a convention in Oklahoma City early in December. They organized the Southwestern Foundrymen's Association with the following officers: President, John Redpath, of the South McAlester Foundry & Machine Co., South McAlester, I. T.; vice president, H. L. Miles, of the Wichita Brick & Iron Co., Wichita, Kan.; secretary, N. S. Sherman Jr., of the N. S. Sherman Machinery Co., Oklahoma City, O. T.; treasurer, G. B. Rogers

Jr., of the Chickasha Iron Works, Chickasha, I. T. Oklahoma, was selected as the next place of meeting and the date set for Jan. 16. The object of the organization of the association is to enable its members to secure more favorable freight rates on raw materials such as coke and pig iron, to place single orders for the entire membership of the association, thus getting the benefit of large quantity purchases; for the discussion of and action upon matters affecting the interests of the foundrymen, to consider labor questions and to work for the mutual interests of the membership.

PHILADELPHIA FOUNDRYMEN'S ASSOCIATION.

The monthly meeting (the 133d) of the Philadelphia Foundrymen's Association, was held at the Manufacturers' Club in Philadelphia on Wednesday, Dec. 2, with President Thomas Devlin in the chair. There was a good attendance present, and before the regular paper the following subjects were discussed: "The St. Louis Model Foundry," "The Difference Between Seventy-two-Hour and Forty-eight-Hour Coke," and "The Advantages of Loam or Dry Sand Castings Over Green Sand Work."

Mr. George C. Davis then presented the paper of the evening, which was entitled "Troubles With Iron and Coke Samples." The paper received some discussion.

NEW ENGLAND FOUNDRYMEN'S ASSOCIATION.

The December meeting of the New England Foundrymen's Association was held Wednesday evening, Dec. 9, at the rooms of the Exchange Club, Batterymarch and Milk streets, Boston, with the president, Henry A. Carpenter, in the chair. About 70 persons were present.

The following persons were nominated for officers for the ensuing year, a new name being presented for president in view of Mr. Carpenter's declination of further official service:

President—B. M. Shaw, Walker-Pratt Manufacturing Co.

Vice President—John Magee, Magee Furnace Co.

Secretary—Fred F. Stockwell, Barbour-Stockwell Co.

Treasurer—George H. Lincoln, George H. Lincoln & Co.

Executive committee of five to be selected from the following: W. B. Snow, B. F. Sturtevant Co.; R. D. Reed, H. B. Smith Co.; J. O. Henshaw, N. S. Bartlett & Co.; A. J. Miller Jr., Whitehead Bros. Co.; W. C. Doherty, Doherty Bros.; J. F. Lanigan, Davis Foundry Co.; R. C. Cunningham, Deane Steam Pump Co.; W. H. Bense, Kinsley Iron & Machine Co.; Harry Gibby, Condor Iron Foundry.

The afternoon paper was by Edgar S. Cook, president and general manager of the Warwick Iron & Steel Co., Pottstown, Pa. His subject was "The Transition from 'Rule of Thumb' to the Application of Scientific Methods in the Management of Blast Furnaces." Mr. Cook traced the advance in blast furnace operations from the old regime of uncertainty to the present-day practice which insured greater regularity of output and consequently assisted greatly toward relieving foundrymen from many irregularities to which uneven working of blast furnaces subjected them.

Archer Brown, of Rogers, Brown & Co., New York, made the address of the evening on "Booms and Reactions in Iron"—a subject on which Mr. Brown has written not a little in connection with the developments of the past six or eight years in the iron trade.

For the January meeting Secretary Stockwell is arranging a strong program. William H. Pfahler, of Philadelphia, will make one address and another will be by a speaker from New England.

NATIONAL CAR WHEEL COMPANY.

In our December issue we find that we published some statements concerning the National Car Wheel Co. which were not correct. In fact, these statements were of a nature which compels us to say that we regret exceedingly having published them, and desire to give to this refutation of the original statements fully as much publicity as we gave the original paragraph.

The Central Foundry Co., of Vincennes, Ind., has closed its plant as a result of recent labor troubles. Some claim that the plant will open again, while others state that the shutdown will be permanent.

The John M. Brandt Co., of Bushnell, Ill., has been incorporated with a capital of $40,000. It is to manufacture machinery. The incorporators are: John M. Brandt, Lurena D. Brandt, John R. Miller.

GENERAL VIEW OF A MODERN GERMAN FOUNDRY.

PITTSBURG FOUNDRYMEN'S ASSOCIATION.

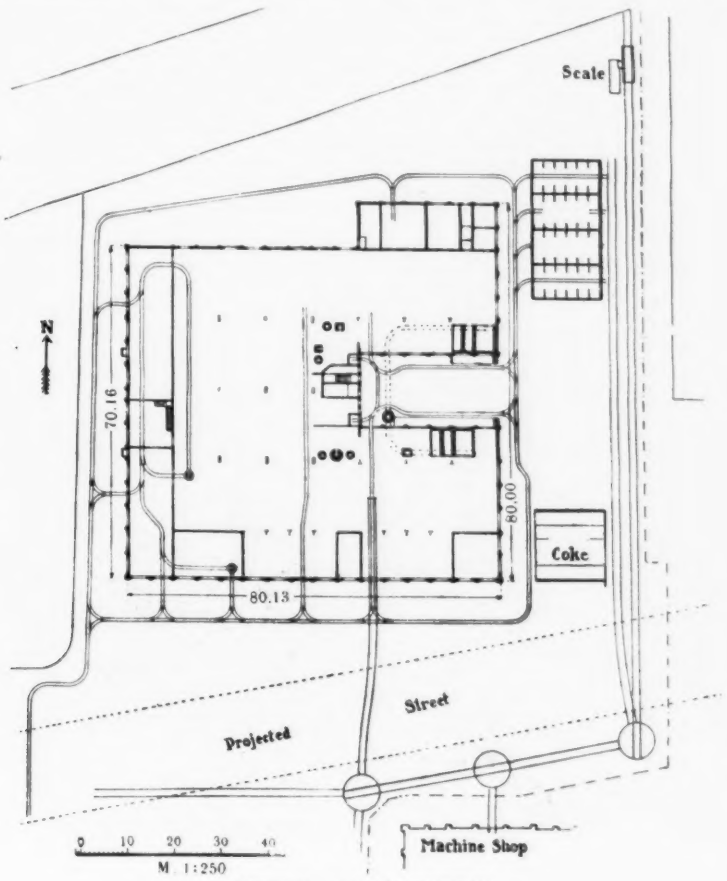
The regular monthly meeting of the Pittsburg Foundrymen's Association was held at Pittsburg on Monday evening, Dec. 7.

The papers of the evening were on "Pattern Making," and were particularly interesting, since they brought up a subject, which, though of large importance, is not much discussed by foundrymen. The speakers were J. C. Warne, of the Pennsylvania Casting & Machine Co., and Edward C. Fitzgerald, superintendent of manual training in the North School, Pittsburg. Both papers were freely discussed.

The plant of the New York Car Wheel Works which was sold recently is to be reorganized under the name of the New York Car Wheel Co. Joseph H. Berry, of Detroit, is president, Solomon Ginsburg, of Detroit, is vice president, and William G. Smith, also of Detroit, is secretary and treasurer. The capital is $300,000. It is understood that Mr. P. H. Griffin, who had charge of the old plant as manager, will be retained.

A Modern German Foundry.

Oscar Leyde, of Berlin, in Stahl and Eisen, describes the foundry of Ludw. Loewe & Co., of Berlin, Germany. The foundry was erected for the purpose of providing gray iron castings for its machine tool and electrical departments. The plant was designed to have an annual capacity of 2,500 tons, and this output can be increased to 4,500 tons, as the demands of the tool and electrical departments increase.



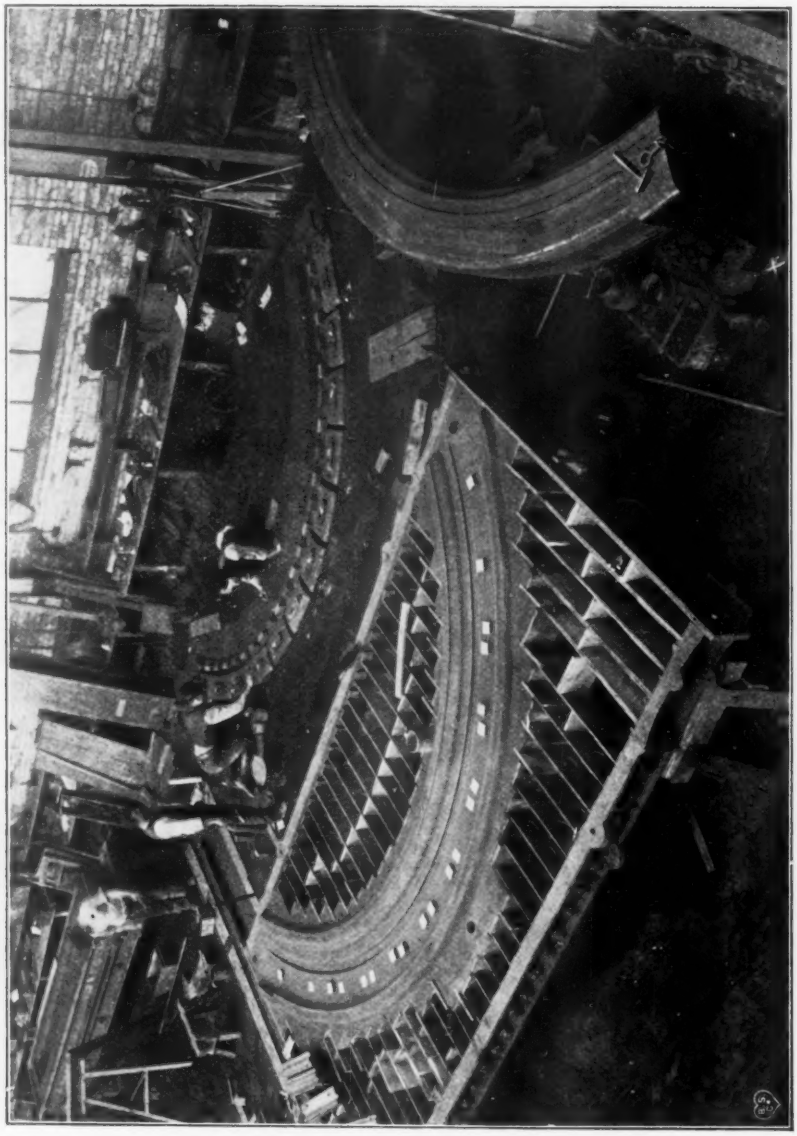
GENERAL PLAN OF FOUNDRY.

General Plan of Plant.

Raw material for the foundry is deposited in the stock yard located in the northeast end of the plant, from which it is distributed over an industrial railway system to the various departments, the coke and iron being transported to the elevator to be deposited on the cupola charging floor, and the sand being carried to the molders, coremakers and to the sand mixing department. The cupolas are located in the center of the plant, from which the iron is distributed to the molding floors. The castings are then carried in a westerly direction to the cleaning room and from the cleaning room they take a southwesterly course to the shipping room, the entire plant being laid out with a view of having the material take a diagonal course through the plant, from the northeast to the southwest, the machine department of Ludw. Loewe & Co., for whom nearly all the castings are made, being located south of the foundry.

Buildings.

The foundry consists of four buildings, each 15m (49 feet) wide, the two located on the north and south respectively being 70m (230 feet) long and the two located between these buildings being 30m (98 feet) long. Each



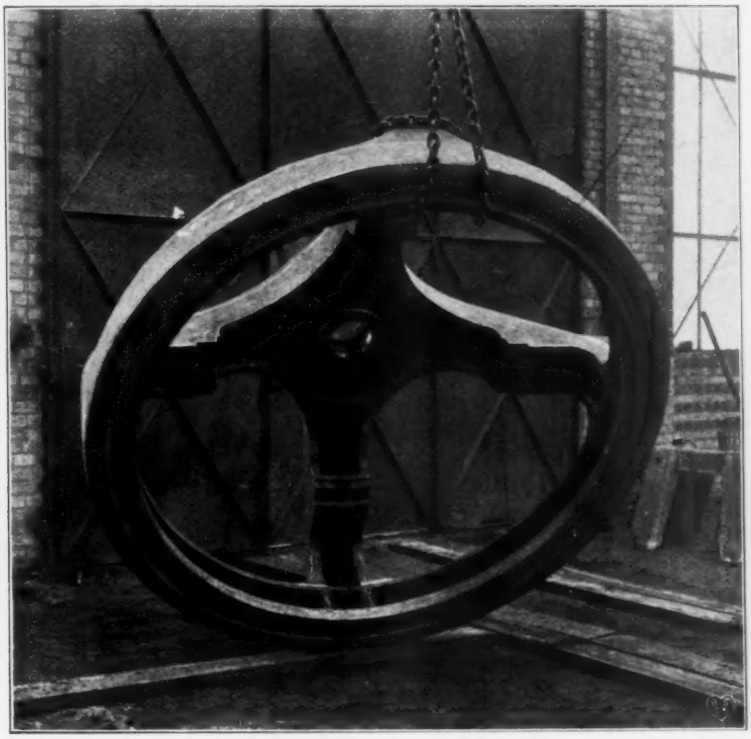
A MODERN GERMAN FOUNDRY. A LARGE MOLD FROM PATTERNS.

building is provided with craneways to carry two cranes of 15 tons capacity each, so that they can be transferred as desired according to the work at hand from one building to another. The main north building has a lean-to 30m (98 feet) long and 10m (33 feet) wide for offices, lavatories and pattern shop; on the west side of this building there is a lean 70m (230 feet) long and 10m (33 feet) wide for the cleaning and grinding departments; the main building in the southerly end of the plant has a lean 70m (230 feet) long and 10m (33 feet) wide, containing the shipping room, molding floor for small castings, lavatories, sand grinding department and carpenter shop, while two other lean-tos, each 30m (98 feet) long and 7.5m (25 feet) wide, contain the drying rooms and small core department. In the center of the plant, in a space 30m (98 feet) long and 10m (33 feet) wide, are located the cupolas, engine room, closets and a small store room.

Cupolas.

Owing to the variety of castings required for the machine tool and electrical machinery department, both in size and quality, a

number of cupolas of different capacities had to be installed. The plans call for two cupolas of 100cm (40 inches), two of 80cm (31½ inches) and two of 60cm (23½ inches) capacity, inside measurement, of which two of 100cm and one of 80cm and one of 60cm have been installed. The two large cupolas provide iron for the molding floor located in the main south building, while the medium sized cupola provides iron for the northerly section and the small cupola provides iron for the molding floors located in the center of the ground, that of the smaller cupolas 5.5m (18 feet). The stacks of the larger cupolas are 5m (16½ feet) high, that of the medium sized cupola 4m (13 feet) and that of the small cupolas 4.1m. A 25m (82 foot) smokestack has been provided for the two cupolas which are to be installed in the future, and this is provided with a spark-catcher. The cupolas were installed by Krigar & Ihssen, of Hanover, Germany, and have been kept in constant operation without the replacement of many of the tuyeres. The guage on the cupolas does



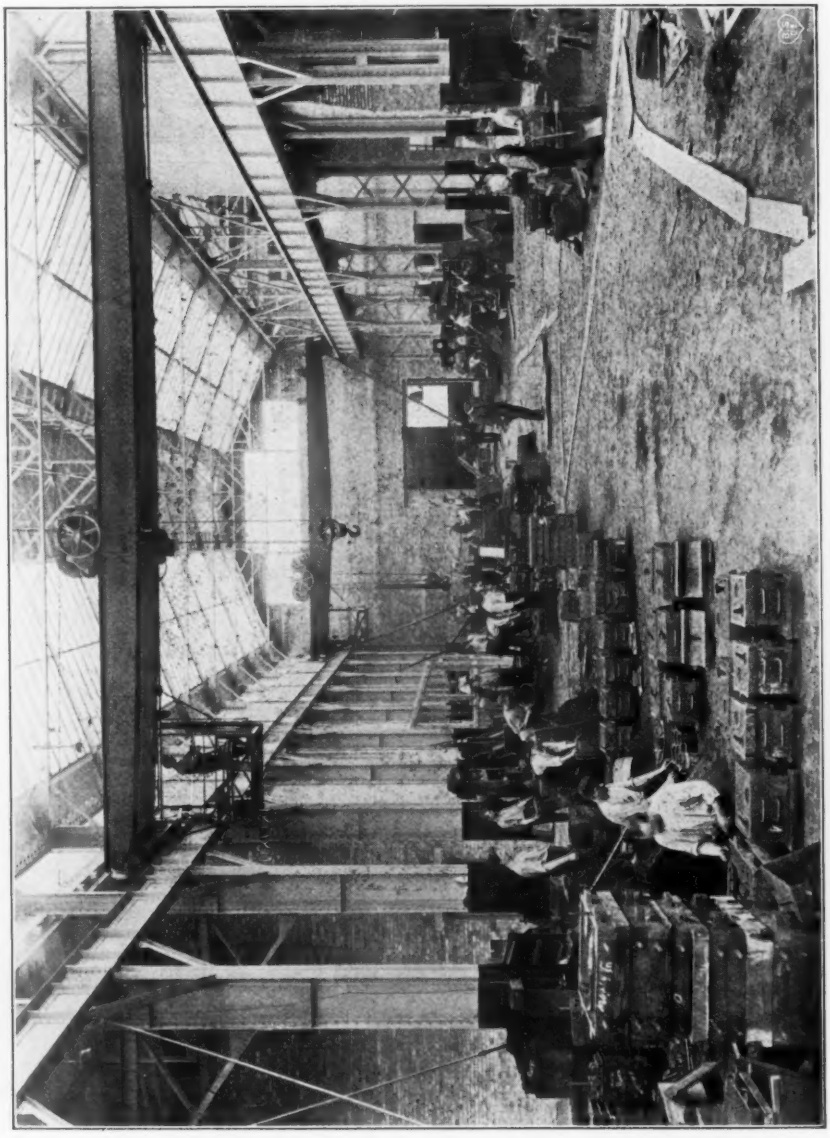
CASTING MADE WITH A SWEEP.

plant. The number and sizes of the cupolas have proved an excellent arrangement, inasmuch as the output has often reached 40 tons daily, when three of the cupolas would be in use, while there have been occasions when only three or four tons were cast and only one cupola was in use. There have been occasions when as high as six and even more mixtures were required for the day's cast and the four cupolas proved none too many. Two cupolas are generally in operation every day.

The cupola charging floors of the larger cupolas are 6.5m (21 feet) in height from the not indicate the blast pressure in the air pipes or in the air reservoir, before it passes the tuyeres, but indicates the pressure in the cupola, dependent, of course, upon the charge and its working. The blast is furnished by three Sturtevant fans, a No. 7 for the large cupolas and two No. 6 for the smaller ones. The fans operate at the rate of 2,000 to 2,700 revolutions per minute and provide a blast pressure indicated by a water gauge of 55cm (21½ inches) for the larger cupolas and from 42 to 47cm (16½ to 18½ inches) in the smaller cupolas. When making large casts the large

fan provides blast for both large cupolas at the same time, giving sufficient hot iron with a blast pressure of 30 to 36cm (12 to 14 inches) as indicated on a water gauge. Under these circumstances the large cupolas provided only 4.5 tons of iron per hour, as compared with 5.5 tons when the large fan is operating on only one of the large cupolas. The medium sized cupolas deliver 3.5 to 4 tons per hour and the smaller cupolas from 2.5 to 3 tons. The three fans are operated by electric motors, the largest one is operated by a motor of 30 h. p. and the smaller ones by motors of 15 h. p. capacity.

The charges of the three different sized cupolas consist of 800, 500 and 300 kg (1,860, 1,100 and 660 pounds) of pig iron respectively, while the coke charged for the three is 450, 450 and 300 kg (205, 205 and 136 pounds) respectively.



SOUTH END OF PLANT SHOWING AMPLE LIGHT IN THE MORNING.

Molding and Cleaning Equipment.

As most of the work is done in wet sand, and dried molds are not used extensively; the drying and core ovens are of the simplest

possible design. They are fired from the outside and have one flue which is provided with a smokestack 20m (65 feet) high. The foundations have also been laid for the erection of another stack.

A sand sifting machine and a sand mixer operated by an electric motor are provided to prepare the sand. Most of the molding is done in green sand from patterns, but some molds are made with a sweep. Molding machines are used for duplicate work, eight pairs of Hillerscheidt and one Pridmore molding machine being in daily operation.

The cleaning is done with sand blast, tumbling barrels and emery wheels, and the smaller castings are cleaned with excellent success by pickling, this process giving an elegant finish to the castings. An exhaust fan keeps the cleaning room practically free from dust and flying particles.

Handling Device.

As castings up to 15 tons in weight are cast for the electrical department, traveling cranes had to be provided to handle the material with dispatch. Two electric traveling cranes have been installed to command the main molding floor of 15 and 10 tons capacity respectively; the large building located in the north end of the plant is commanded by two electric cranes of 3 and 5 tons capacity. The Shaw company installed five of these cranes. The industrial railway system which is used for carrying material to various portions of the foundry was installed by the C. W. Hunt Co., and gives excellent service. A standard gauge track leads into the south building.

PIT MOLDING.

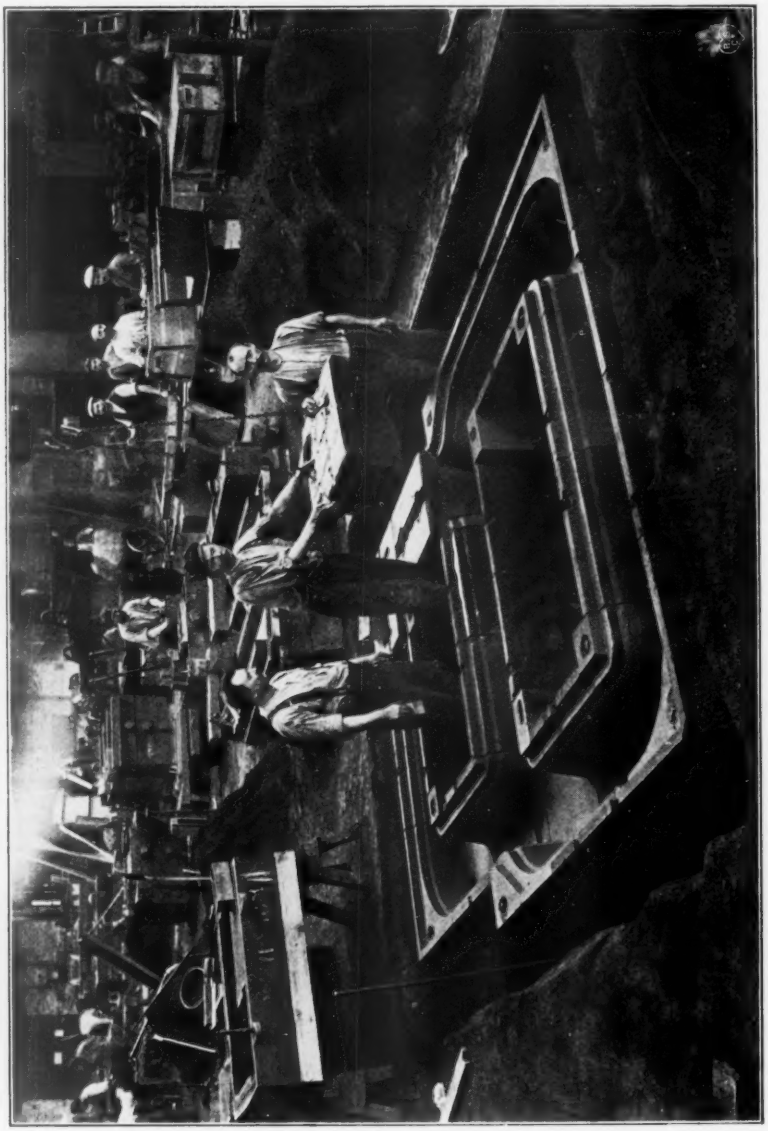
Heating System.

The problem of heating the foundry was given much thought. Owing to the large number of windows in the plant, making an ex-

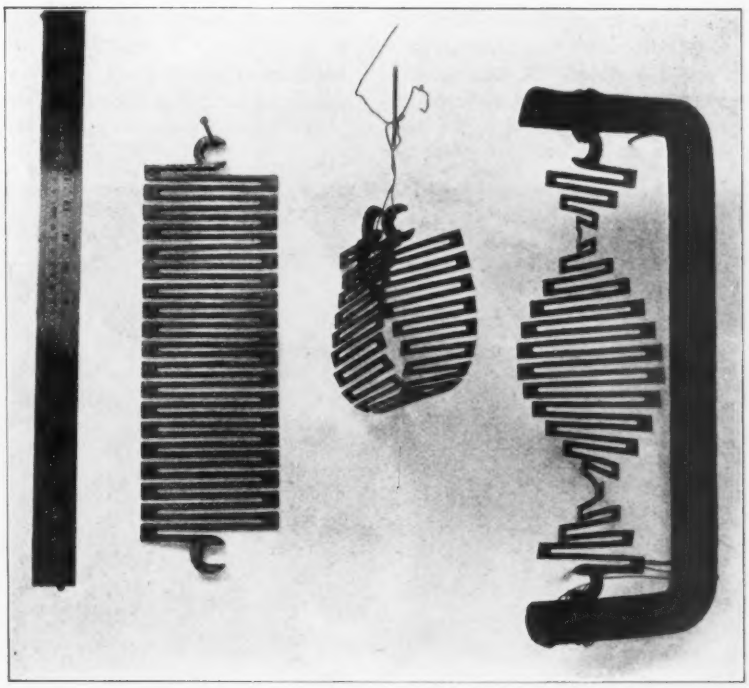
tensive cooling surface in the winter time, an extraordinary large heating plant had to be installed. Warm air is delivered into the foundry by two Sturtevant fans 3m (9.75 feet) in diameter each, which are operated by an electric motor of 20 h. p. capacity. The warm air travels from the west end of the plant to the eastern portion and additional heat is furnished in the latter section by the core ovens. While pouring in the afternoon, the heating system is not in operation. On cold days the heating system is placed in operation early in the morning, so that the entire plant will be comfortably heated at 7 o'clock, when the employes begin work.

Sanitary Arrangements.

An extensive wash room has also been provided, located in the cellar underneath the west lean-to. In this room each employe has his locker, which is made of wire and well aired, the wash bowls being located between the rows of lockers and are filled with warm water when the men quit work in the evening. Twenty-four shower baths are provided in a separate room at the disposal of the molders and other employes. On an average, 35 per-



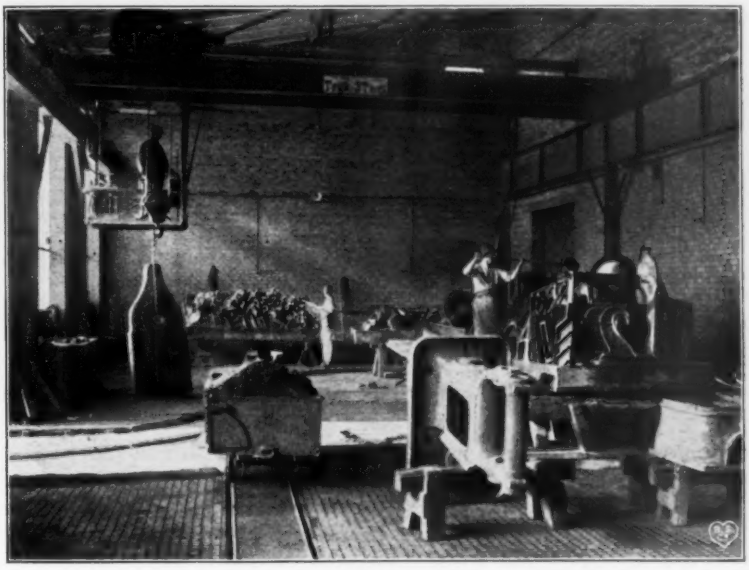
A MODERN GERMAN FOUNDRY. PIT MOLDING.



SOME TEST PIECES.

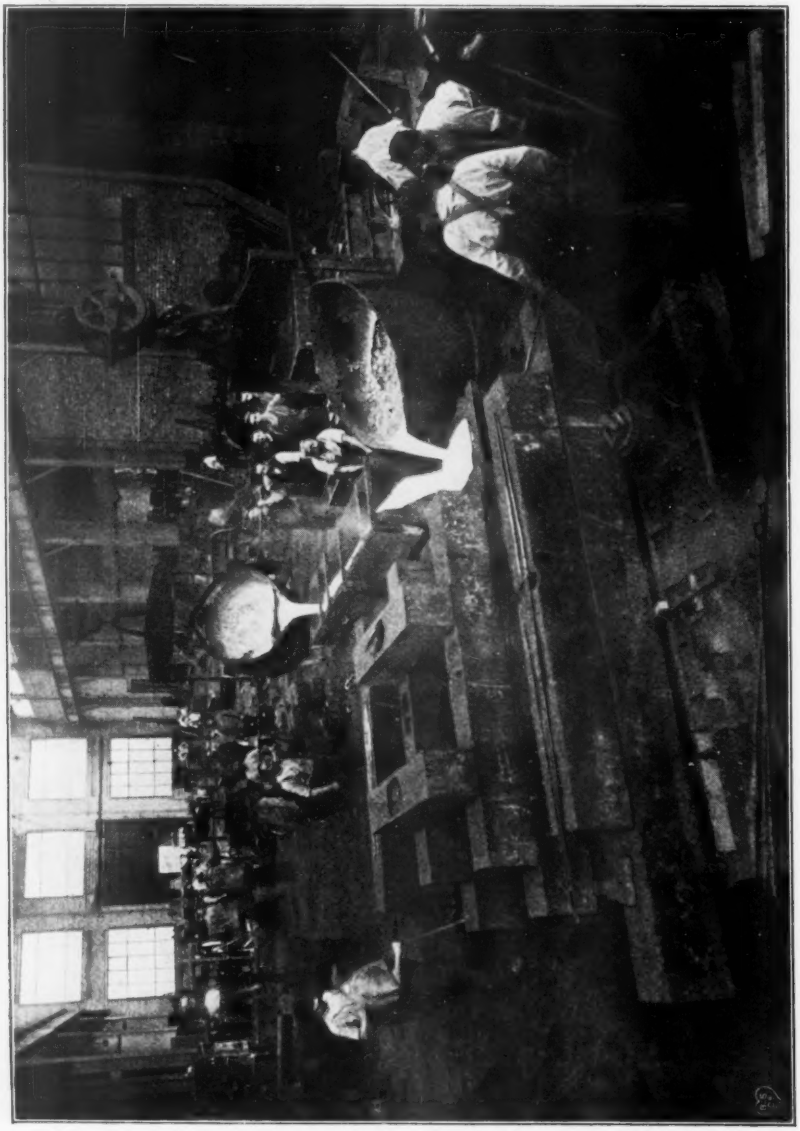
cent of the employes utilize these shower baths every day in the year, while in the summer time as many as 80 percent of the employes took advantage of them. Thirty closets are provided for every 300 employes despite the fact that the government only requires 20 for this number.

Water is provided for all purposes except



PICKLING DEPARTMENT.

drinking from the company's own plant, the city water being provided for drinking purposes. For power purposes the electric plant delivers a 500-volt direct-current and 110 volts is provided for lighting purposes. Gas from the municipal gas plant is held in reserve for lighting.



SOUTH END OF PLANT SHOWING AMPLE LIGHT LATE IN THE AFTERNOON.

Laboratory Work.

A laboratory is provided for making chemical and physical tests, none of the pig iron being purchased without a guaranteed analysis and scrap is not purchased very often without a trial analysis. Coke must also be guaranteed as to analysis. In addition to the guaranteed analysis, tests are made of every car of iron delivered, borings being taken from 10 separate pigs. Tests are also made of every cast. As the quality of the iron delivered by the furnaces is bound to vary from time to time, iron from different cars and also various brands are used to average up the mixtures.

In making thin castings the contents of silicon vary from 1 to 3 percent and should a casting containing 2.3 percent silicon be

required, iron containing the following analysis would have to be averaged:

	Silicon.	Sulphur.	Manganese.	Phosphorus.
Own scrap	2.20	.120	.70	.80
Outside scrap.....	2.15	.130	.50	1.20
Soft hematite iron...	3.56	.028	.90	.22
Hard hematite iron..	1.80	.025	1.20	.18
Addition of No. 3..	2.65	.045	.50	1.55

As about .20 percent of the silicon is lost in melting in order to secure a casting containing 2.3 percent silicon, a mixture containing 2.5 percent of silicon must be used. Considering the cost of the pig iron and the content of phosphorus it may be desirable to have the mixture contain 50 per cent. of scrap, of which 35 percent made in the plant is at hand and 15 percent of outside scrap must be used. Should 25 percent of a cheaper No. 3 iron be used the remaining 25 percent of the mixture should be made up of hematite containing a high percentage of silicon. Therefore in order to secure a casting containing 2.3 percent of silicon, the mixture should be made up as follows:

	Silicon	Sulphur	Manganese	Phosphorus
35 per cent own scrap.....	(2.20) 0.77	(0.120) .042	(0.7) 0.25	(0.80) 0.28
15 " outside "	(2.15) 0.32	(0.130) .019	(0.5) 0.07	(1.20) 0.18
17 " soft hematite	(3.56) 0.62	(0.028) .005	(0.9) 0.15	(0.22) 0.04
8 " hard "	(1.8) 0.14	(0.025) .002	(1.2) 0.10	(.18) 0.01
25 " No. 3.....	(2.65) 0.66	(0.045) .011	(0.5) 0.12	(1.55) 0.39
100 per cent	2.50	0.079	0.69	0.90

The mixtures to achieve various results are now practically fixed and chemical analyses are only made from time to time for the purpose of controlling the same, or when a casting turns out bad and the mixture is believed to be the cause. On the other hand test bars are taken from every cast for the purpose of ascertaining the physical properties. Bars are taken for ascertaining the tensile strength, chill and shrinkage, and especially constructed boring machine with diagram indicator shows the degree of hardness of the test bar.

The question of ascertaining the costs is one of great importance, as very few of the larger castings are in duplicate, and while the majority of the castings are made for the company's own use, some job work is also taken in. Furthermore, the actual cost of making large castings ranges from 11 to 12 marks per 100 kg ($2.62 to $2.85 per 220 pounds), while on the other hand castings for complicated automobile cylinders and others of unusual difficulty run up to 100 marks and over per 100 kg ($23.80 per 220 pounds); it can be readily seen how hard it is to arrive at an average price to secure a profit. In view of these difficulties the cost of all castings is figured according to weight on the basis of a standard price for iron, the latter naturally varying according to the fluctuations in the cost of raw material.

A GIGANTIC CASTING.

BY A NEWSPAPERMAN.

The intermediate cylinder of the triple-expansion engines for a large ship of war is about to be cast. In one corner of the great foundry there is a palpable air of something impending. Two days ago there had been, a few feet to the rear of the furnaces, a hole in the ground, roughly 20 feet square and 10 feet deep. The outer part of this was an empty moat, the bulk of it was filled with a kind of martello tower of brickwork with buttresses and flanges protruding here and there. Inside the tower was the core of the cylinder. Now the moat was filled level to the surface with sand that was rammed as tight as ramming could make it. A huge stone lid had been bolted down upon the top, leaving only two square apertures that narrowed into small channels, whence the molten liquid would find its way into the core. It is to be poured simultaneously from two ladles. There seems to me to be a demoniac Titan kind of humor in the name of these vessels. A ladle is a thing that you help soup with or scoop up bread sauce to put beside your portion of pheasant. The smaller one of these ladles was, when I arrived upon the scene, resting under its attendant crane, ready and full, holding 11 tons of liquid iron. The great hook that linked it to the chain and the chain itself were slightly bent, giving the crane an appearance of lolling carelessly over the little load it was presently to swing up. It could lift 40 tons if it liked. The larger ladle, sunk

into the ground to bring its lip level with the mouth of the furnace, is still being filled. The foreman comes and goes, watching its progress. It must be an anxious time for him, but he has a perfectly confident, almost jaunty, air. His hard hat is on the back of his head, and when he is not warding off heat with a crooked arm, his hands are behind his back supporting quite unnecessarily the bottom of a short, tailless black coat.

At last the great ladle with its 15 tons is full almost to the brim and it begins slowly to rise. As it goes up a dozen men with shovels fill in the hole under it. The noise of the cranes and other machinery makes for an almost complete human silence, broken only by the cheery, sharp voice of the foreman. There is a wheel attached to each ladle for the purpose of tipping; it is a kind of helm. A man takes command of each ladle, stands to the helm, and they are tipped back slowly and very slightly away from the buried spaces waiting their fiery filling. Now like two great pots of soup, they are skimmed by men with 12-foot-long steel rods with ends like the ends of a hockey stick. The sand and ash thrown in as they were filled to preserve an even heat are dragged out in flaming chunks that throw out great stars and sparks as they fall to the ground. This finished, the helmsmen once more right their charges and they are swung carefully round to tipping distance from the square holes. Right in the middle stands the foreman, and other men are close to him. There is a moment's pause, a last look round. The afternoon is growing darker; a hand goes up, and two streams of shining seething liquid fire dash down into the square holes, foam up, wash back again and settle into a steady pouring. At the first fiery splash there is thrown out from the double glory with hither-and-thither carelessness a veritable firmament of huge starry fragments, their color a dark blue-white. These are mingled with the largest things consistent with the name of sparks, dull red, glowing.

They drop a foot from the ladle, they are thrown 20 feet; there is a glorious haphazardness about them, they seem to be hurtling themselves joyfully, though at the cost of speedy death, from this inconceivable burial. It seems to me that if all who would could see a big casting there would never again be any money in fireworks. For this is more beautiful than all fireworks, and, as with a good story, and as not with fireworks, there is so much left to the imagination. That molten metal with its beautiful inanimate vitality is, in another shape, to help work a mighty British warship across and across the world's waters. Oh, yes, it is better than all fireworks to see the casting of a big cylinder.

Making a fire circle of still more varied colors than the sparks and the molten metal are the vent pipes from which the escaping gases force their way up from below ground. Some are blue, some white; some, like the shooting stars, can only be called a dark-blue-white, but they have little jagged sticks of yellow light coming up through them like a fiery porcupine shooting out quills of gold.

Still the two streaks of tropical sunrise are pouring, have been pouring for about two minutes, when suddenly on the far side from where I stand there appears a man shaping furiously, as if for guarding from the fists of an antagonist, his left arm swinging up and down across his face and body. He is peering down into a certain part of the narrow channel, where the rising metal will first show. He fights three rounds with the awful heat, then puts up his hands, the foreman signals to the helmsmen, and the ladles swing up. It is over. The big cylinder is cast. Yesterday it was chunks of pig iron lying out in the yard, looking very much as if it had already done its work and been raised from the bottom of the sea, for it is a pockmarked mass of rust, spotted here and there with streaks of sand and stuff that might well be dried seaweed. Today, now it is a living, struggling liquid, that would fain burst from the spaces, niches, and crannies that it has been ruthlessly poured into. It is so deadly powerful, and yet so helpless; men are prodding it from above with long rammers, to keep it moving, lest there be any corner unfilled; it is to die hard. Tomorrow it will be an integral part of the great warship, its destiny. The big ladle has been swung out through some giant doors in the open air; the little ladle has emptied itself on to the floor, and the metal runs hither and thither in tiny sand ridges that look like children's fortresses on the seashore. The weird lights from the vent pipes burn low—they go out.—[London Pall Mall Gazette.

The Webster Mfg. Co., Chicago, has been incorporated with a capital of $30,000, to deal in machinery, engines and foundry appliances. The incorporators are: Towner K. Webster, A. T. Perkins, John P. Lenox.

THE WEVER TRIPLEX BRASS FURNACE.

BY PAUL WEVER.

In the June issue of THE FOUNDRY 1900 I gave a short description of some Piat-Baumann brass furnaces which I was then using. After I had worked with these for a couple of years I found that brass made of 60 or 70 per cent copper, and 40 or 30 per cent Zinc was never so uniform nor so completely alloyed as the brass coming out of the old common crucible furnaces. At the same time our loss in bad castings made from this kind of brass run up to almost 10 per cent, while when we were receiving our metal from the old style crucible furnaces our loss had never exceeded 3 to 4 per cent.

We make it a point to distinguish between the direct, or foundry loss, and the indirect, or the loss of castings, which is not known until these have reached the machine shop. The direct loss of the foundry is always found immediately after the castings are poured or in the shipping department, as no defective castings are delivered, these being instead weighed up and checked back to the metal store room. The indirect loss in castings is not known until these have been delivered by the foundry and accepted by the machine shop, and in the majority of instances considerable work is expended upon these before it is known that they are defective.

During the last year our indirect loss has not been more than 1.25 per cent, but the direct loss has been as much as 6 per cent. I may add that my experience has taught me that the profitableness of a brass foundry really depends upon a few per cent more or less of direct loss in spoiled castings. With a very simple pyrometer, which is easy to handle in the foundry, this percentage may be lowered. Many experiments are being made in this line at the present time, and I believe some success will come therefrom. In the Siemens & Halske foundry trials are being made with a photo-pyrometer. The details of these will be published as soon as proof of satisfactory results is obtained.

In regard to the difficulty which we experienced with an alloy of 60 per cent copper and 40 per cent zinc, when melting this in the Piat furnace, I could not agree with the foundry foreman in his opinion that the very speedy melting of the copper and zinc in this furnace could not result in a complete alloy, especially if this alloy was raised to a sufficient temperature. In one way and another I became convinced that the whole melting process in the Piat furnace occupying such a short period would require more careful attention than the old slow way of melting. In my opinion to ensure complete alloying one has to depend more or less upon a good stirring of the molten metal, and this is hard to do in a

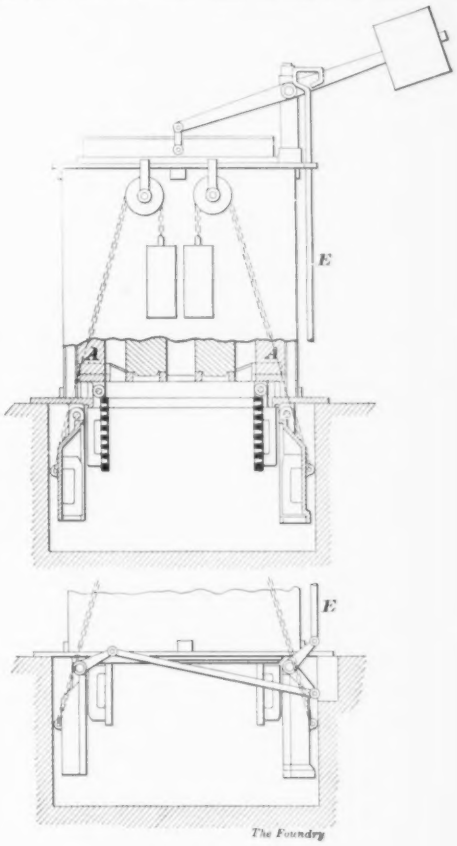


FIG. 1.

Piat furnace, the melter being hindered in doing so by the construction of the furnace and even when he takes considerable pains finds trouble in stirring the metal clear to the bottom of the crucible. Besides, in this furnace the flame from the fuel goes through the hopper above the crucible, which contains the melting stock, and it is possible that some of the sulphur from the coke may be absorbed by the copper, thereby causing part of the loss of spoiled castings referred to.

Another disadvantage I found in the Piat furnace is the loss of heat in the metal, due to pouring this into a ladle from the furnace, and then into the molds. For very thin castings the metal has to be over

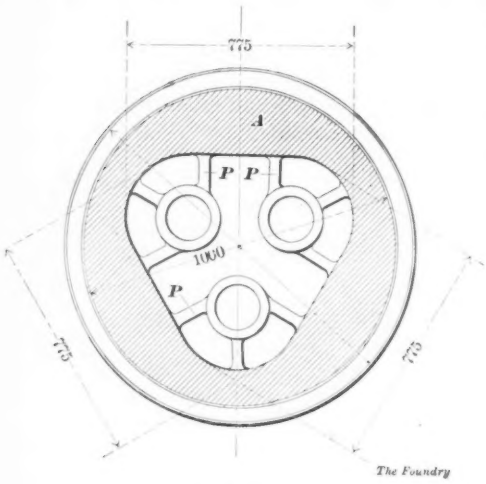


FIG. 2.

heated pretty highly, thereby causing a greater loss in oxidation, and even with a very high original temperature in the furnace many molds were not filled properly owing to insufficient fluidity in the metal by the time this reached the molds. We tried to overcome this difficulty by pouring the molds in a vertical instead of a horizontal position. By this method we succeeded in reducing the amount of misrun pieces, but the castings were not as smooth as when they were poured in a horizontal position. We made many trials to obtain a facing sand which would avoid these rough surfaces, but did not succeed in making any great improvement. In pouring the molds in a vertical position we avoided the use of risers, and consequently the proportion of castings to weight of metal melted was greater than when pouring the molds flat. In consequence of the higher pouring head and subsequent greater pressure to which the castings were subjected, these had a greater density, but for our use they were not smooth enough, and as we did not succeed in securing a facing sand, which would not be affected by the liquid metal, we discarded this system of pouring and returned to our original method of filling the molds in the position in which they are made.

However, for all other alloys with the exception of the one containing 40 per cent zinc, I would not miss the use of the Piat furnace. The remelting of clean and insulated copper wire is very easy of accomplishment with the hopper with which the crucible if fitted, together with a funnel shaped preheated which can be fastened onto the hopper. With such an outfit the whole charge of old wire necessary to fill a crucible can be charged at once before melting begins, and this is not done any cheaper or easier in any other furnace. What we call red brass, consisting of 80 per cent copper, 13 per cent zinc, 5 per cent tin and 2 per cent lead, or bearing brass, consisting of 84 per cent copper, 12 per cent tin and 4 per cent lead, or phosphor bronze, composed of 90 per cent copper and 10 per cent phosphor tin, as well as other alloys of copper, aluminum, zinc, etc., may be melted with the best results in the Piat furnace. The only difficulty we ever had in obtaining satisfactory metal from the Piat furnace was with an alloy high in zinc previously mentioned. To overcome this I constructed a new furnace specially for the melting of such alloys, and it was my intention that this furnace

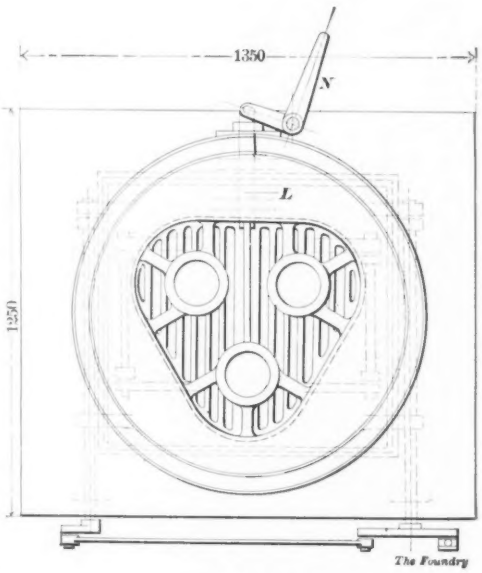


FIG. 3.

should have the points of superiority to be found in the Piat furnace, that is, it should be able to melt with a consumption of 15 to 20 per cent of fuel as compared with the weight of metal melted, at the same time,

it was may desire that the disadvantages described should be avoided.

The result of my experiments along this line may be seen in the attached illustration, Fig. 1, of what I call my "Triplex" brass

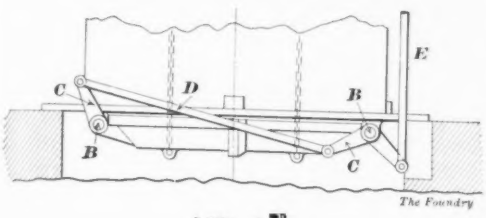


FIG. 4.

furnace which holds three crucibles at one time. The measurements shown are given in millimeters. The advantages of using, what we may call the Wever system, as compared with the common one-crucible furnace is that we may melt a very large quantity of metal, and yet use small crucibles, say of about 120 pounds capacity, which are easily handled. At the same time we obtain a large heating surface for the hot gases to act upon the crucible, and this results in very steady melting being done, avoiding as we do a loss of heat through radiation by keeping the surface of the fire box as small as possible, points which are not to be found in the common one-crucible furnace, but will be readily understood by the practical melter and will make unnecessary any further explanation. As compared to the Piat furnace, the loss of heat through pouring the metal into a ladle and then into the mold is avoided.

The room necessary to install one of these Triplex furnaces is just about the same as is required for a one-crucible furnace. In charging and stocking the new style of furnace less time is required for three crucibles in one furnace than for three crucibles in three different furnaces. The lining A we at the present time make of one solid piece for all our furnaces to avoid the joints and grooves which are formed when bricks are used for linings. These joints shorten the life of the lining and allow it to burn out much more rapidly, in fact, I have found that a brick lining will last about one month in one of these furnaces while the one piece solid lining will last about four months. These linings as we use them for the furnace have a cylindrical shape on the outside, while their interiors are reduced to the smallest cross section, as shown in Figs. 2 and 3, thus leaving sufficient space for three crucibles and for the fuel which surrounds these. In this way the amount of wall surface to be heated is reduced to the lowest limit and the loss of heat by radiation is also reduced to a marked degree.

Corresponding to the shape of the lining A the grate has a similar form. The cross section of this is a little larger than that of the base of the furnace. In order to get rid of the cinders and other refuse which result from the operation of the furnace, and may have to be removed several times during the day when melting continually, the bottom is built after the style of the common drop bottom doors of the cupola. Arrangements are made so that the bottom alone, or together with the grate may be dropped. To do this the bottom doors are fastened to the shafts B which revolve in lugs cast onto the bot-

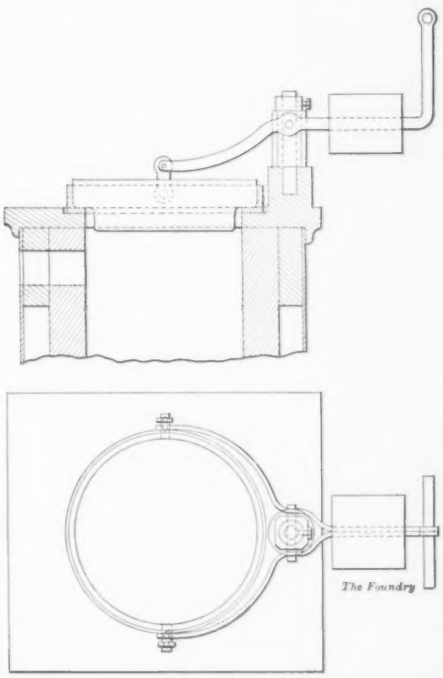


FIG. 5.

tom plate, Fig. 4. By the levers C fastened on the shaft B and the drawbolt D, both halves are so connected that they will pass through similar movements. This motion is ob-

tained through the rod E from which it is plain that in order to operate the grate, it is not necessary for anyone to go below the furnace. The two grates swing in suitable bearings and are fixed in their permanent positions by means of a suitable lock. If the drop bottom has to be opened at the same time as the grate, the lever connected with the lock is used. The two grates then rest with their ribs on ribs which are placed in the bottom doors. The operation of the grates and bottom doors are very plainly shown in the illustration and may readily be traced from this. As will be noted the crucibles rest upon special foundation and not upon the grate. This takes the form of a special frame, which has three rings and is connected by strong ribs to the bottom plate of the furnace. These ribs, P, Fig. 2, are far enough apart so that they will give cinders an easy chance to escape and yet are strong enough to endure any blow which they may receive while the furnace is being stoked. They also leave sufficient space for the air which enters the furnace at this point. It will readily be seen that the bottom doors and grates can be opened while the crucibles are in the furnace. As shown, the blast enters through the air space surrounding the furnace and from this to the grate; in order to have the bottom doors air tight each half is connected from the side to counter weight through a chain. This is fastened to the doors at a point where these very nearly balance, so that an even pressure is maintained against the bottom plate. At this time we are melting in a furnace of this construction three crucibles of metal, each having a capacity of 120 pounds, in from 35 to 40 minutes. We are doing this with an amount of fuel equal to from 18 to 20 per cent of the weight of metal melted.

One may think it is a disadvantage to have all crucibles ready to pour at the same time. This it is quite possible to avoid by making the furnace of a different design but necessarily this would involve a more complicated construction, with many movable parts, and after all it is doubtful if this would work well. We have found that the handling of three crucibles, after they are ready to be removed from the furnace, requires relatively little skill and is easily accomplished.

Cover for Brass Furnaces.

I have recently designed a cover for brass furnaces which is illustrated herewith. Heretofore these have principally been to two kinds. Those which may be lifted off after the manner of a watchcase, and those which are divided into halves, and may be turned aside in a horizontal position. The first arrangement possesses a drawback in the fact that the excessive heat of the cover is an annoyance to the workmen. The second arrangement, as well as the first, has the disadvantage that the cover does not close completely, and this is especially true with the latter design, because the covers must be equipped with a fireproof substance in order to withstand the heat to which they are subjected.

By employing the cover, of which sectional and plan views are shown in Fig. 5, all of these difficulties may be avoided and the cover will rest evenly upon the furnace. The removal of the cover is also made much easier, and access to the furnace more readily secured.

STRIPPING PLATES.

BY P. R. RAMP.

One of the most serious objections foundrymen have against the installation of molding machines is the heavy expense incurred in fitting up stripping plates and patterns. Unless they have a very large number of castings to make from one pattern. They consider it a loss of time and money to fit up a molding machine for the job.

When considering the cost of cast iron stripping plates and patterns, the expense is quite an item although there are several methods for fitting up these plates that help to reduce the cost. One is to make the opening for the pattern in the stripping plate larger than the pattern by ¾ of an inch or 1 inch, and filling the space between the plate and the pattern with babbitt. This is cheaper than the old method as it requires less labor in filling and fitting, still the reduction this affords is hardly sufficient to induce the foundryman to invest his money in a molding machine for producing a limited number of castings.

However, there is another method that greatly reduces the cost of this work, namely: stripping plates and pattern boards made of

wood which enable the foundryman to place old patterns that have been used in the ordinary method on a stripping plate machine with very little expense.

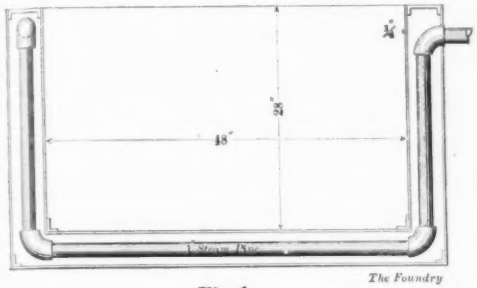
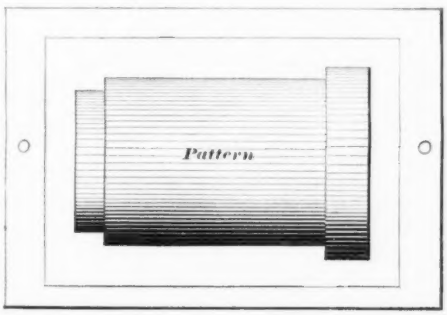


Fig. 1

In order to make these wooden stripping boards so that they will not warp or crack while in use and to wear nearly as long as the metal ones, the lumber should receive the following treatment: Cut the lumber into pieces of the size required for the boards, allowing ⅛ of an inch for finishing after the material is treated, and place them in a tank of boiling crude paraffine, a tank especially designed for this purpose as shown in Fig. 1. The boards should be allowed to boil for ten or twelve hours, after which the steam should be turned off and the paraffine allowed to cool until it begins to congeal. The lumber may



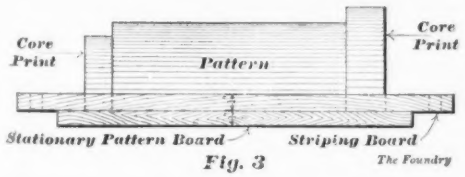


Fig. 3

then be taken out and the excess of paraffine scraped off. Care should be taken to see that the lumber is not removed from the paraffine while it is too hot, as it will not retain the paraffine when at a high temperature.

The tank of boiling paraffine should be constructed as shown in Fig. 1, which is a sectional view of a tank used by the writer for treating boards used on 16 x 26, and 20 x 30-inch molding machines. This tank measures 48 inches long, 28 inches deep and 30 inches wide. It is really a tank within a tank, the heat being applied by a system of steam pipes between the outside and the inside tanks.

Boards treated as outlined above will withstand dampness for almost an unlimited period. Any kind of dry lumber may be used to make these boards. This method makes it possible for even a jobbing shop to operate molding machines successfully.

Section A-B

In order to make the use of these boards clear to all, I have made several sketches of jobs which have been worked in this manner. Fig. 2 represents a bushing for a piston valve for a locomotive cylinder. Fig. 3 shows the pattern in position on the stationary pattern board with the stripping board in position. The upper portion of the view shows a plan, and the lower portion a front elevation of the parts. It will be noticed that the stripping board is 1 inch thick, hence it is necessary to add 1 inch to the pattern. This addition is made between the pattern and the stationary pattern board as shown in Fig. 4.

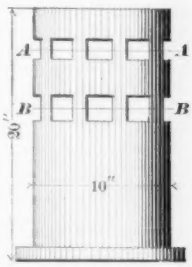


Fig. 2
The Foundry

In fitting up a stripping board, a center line should be drawn across the board on a line with the holes used for the guide-pins; a center line should then be drawn across the pattern. The pattern is then laid on the board in such a position that the center lines coincide and the outline of the pattern marked on a board with a sharp pencil. The board should then be cut out on a band saw, and if care is taken in following the outline of the pattern, the stripping board will be completed without any further labor. Fig. 4 shows a sectional view of the half of the mold made from this pattern. The pattern is also shown

upon the pattern board as it would appear after having been drawn through the stripping plate. In this illustration A represents the stripping plate, C the stationary or pattern board and B the thickness that is added to the

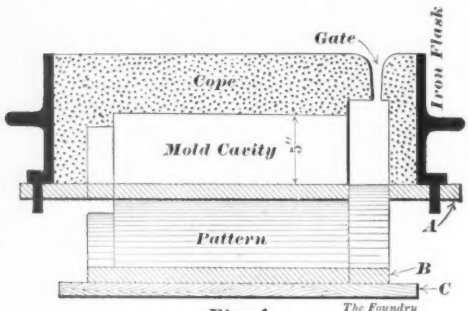


Fig. 4

pattern to allow for the thickness of the stripping plate. Fig. 5 shows a section of the completed mold.

It may be of interest to some to notice the method of gating this mold. The gate is formed by ramming up a small gate-core in the large central core.

This job was taken from an ordinary molding floor and fitted up for a molding machine at a total cost of $2.00. The reduction in the cost of labor for molding was 80 percent.

Where old patterns are used that are split in halves, one pattern will do for two castings in a flask as shown in Fig. 6, which represents two halves of a jackscrew pattern. In this case the core-prints A were attached to the stripping plate board, and only the patterns

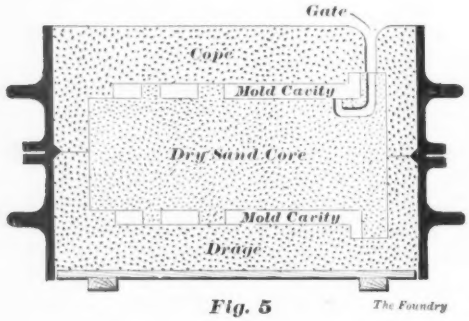


Fig. 5

proper were drawn through the board. These boards can be used on any stripping plate machine.

I do not think it will be amiss to say a few words in regard to molding machines in *The Foundry*. It has been my experience that the molding machine best adapted to general use is of the greatest value to the jobbing shop. At the present time the writer has such a machine in operation which produces castings weighing from 10 to 1,600 pounds and at the

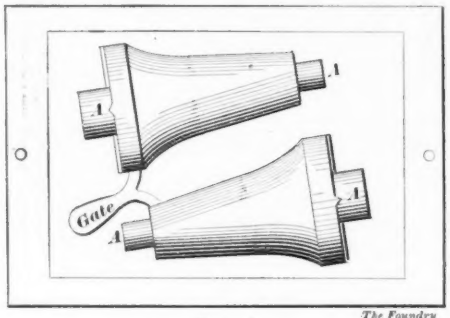


Fig. 6

same time reduces the labor from 50 to 75 percent. However, in obtaining good results, a great deal depends upon the man behind the machine.

THE BOTTOM OF A GREEN SAND MOLD.*

BY THOS. D. WEST.

In selecting the subject for this meeting, I have, as will be noted by the title, made a radical departure from the character of papers heretofore presented to your association. I trust, however, that the new thoughts presented and the idea of adopting standards for making beds will prove interesting to all those present and lead to better practice in making green sand castings.

Most foundries follow wrong lines in forming the bottom part of green sand molds. When molders are left to follow their own ideas, it is uncommon to find two working on the same lines, and the chances are that many will be using incorrect methods or working unintelligently.

Before proceeding to illustrate methods commonly practiced, it will be well to mention the principles involved in the right construction of mold bottoms or beds.

Two of the first lessons we learn when engaging in the art of founding, is that molten iron will not lie quietly upon dense damp sand or upon rusty iron, and that it exerts pressure according to the height of its head or column, similar to water or other fluids. The way some molders work would lead one

*Read before the New England Foundrymen's Association, Boston, Mass., Nov. 11, 1903.

to believe that these fundamental principles were only discoverable after many years of sad experiences. Having knowledge of the fact that molten iron will not lie quietly upon dense damp bodies, and that as height of head increases, so does pressure, we have the foundation of intelligent manipulation in making mold bottoms or beds. In stating these principles we have first to ask, why will molten iron not lie quietly upon dense damp bodies? It is because the metal's heat creates steam, which will escape by the road of the steam and pressure, it is next in order to treat of the effects of their combination and the conditions which should prevail to best counteract their evils in constructing mold bottoms. The dampness or "temper" is controlled by molders generally much better than the density. The chief trouble lies in obtaining a proper and uniform density. The ideal condition is to have the face of a mold as soft as possible and the under body sufficiently hard or solid to withstand the head pressure or strains that will be exerted upon it when

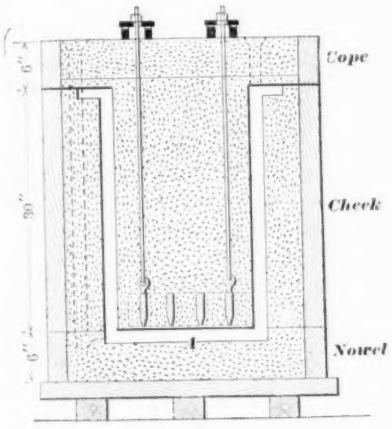


Fig. 1

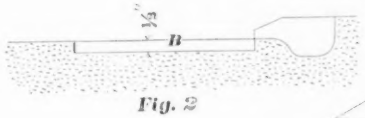


Fig. 2

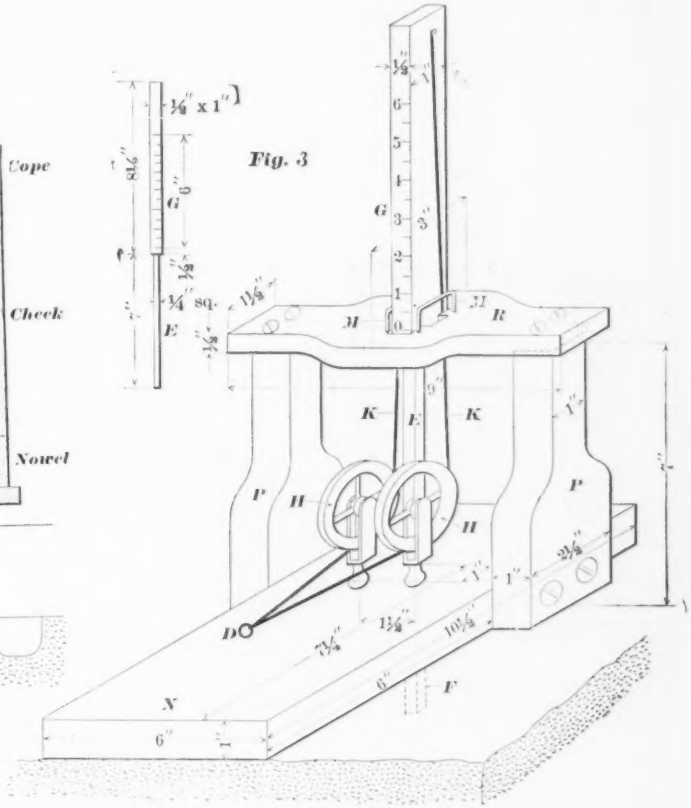


Fig. 3

least resistance, and this as a rule is up through the molten metal. This escape may not cause much disturbance or it may be so violent as not only to cause scabs, etc., on a casting, but blow the metal out of the mold so as to make the casting nearly unrecognizable when compared with its pattern. In considering head pressure we have but to recognize the fact that with equal pressure of metal we must have equal density or hardness of mold body under it, if we wish the bottom of a casting to be true to its pattern.

Having briefly considered the effects of the mold is poured. If the bottom of the mold is not of uniform density thin castings will warp or crack, due to disarranged or unequal thickness, and heavy ones will have swells on the bottoms, or give way so as to cause burst-outs and the castings be lost.

To overcome evils of dampness and density, we resort to venting. This can often prevent the injury that errors in "tempering" and ramming sand would otherwise cause, provided it is done intelligently. While venting is a necessity with most all kinds of bottoms, excepting with most "open sand" work, there

is a limit to its utility. Venting cannot prevent ill results where the surface sand is excessively damp, fine or is rammed too hard. We can ram the under body of a bottom excessively hard and all will work well if it is well vented and the surface is of open sand, dry as can be worked and sufficiently soft. As a rule the damper or finer the sand, or harder the ramming, the more venting required. This leads to the inquiry, how damp should sand

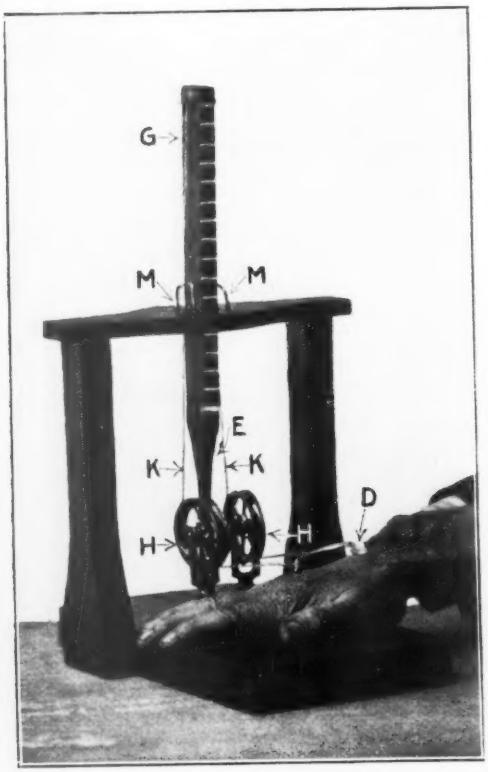


FIG. 4.

be mixed, how fine should it be used, and what degree of hardness is desirable?

Comparison of Compression in Dry and Wet Sands.

The drier the sand can be used the better, as the drier sand means that less steam will be created to cause trouble and labor in venting. Dampness is required wholly for the purpose of maintaining forms, affording an oportunity to finish them and to prevent the rush of flowing metal washing away the sand. Excepting the first inch or two of the surface, the bottom of some molds could be sustained with sand in a dry powered state, were the sand sufficiently coarse to admit the downward escape of the steam that would be generated from the damp surface sand. On account of the inconvenience of using all dry sand and the risk of the damp surfaces parting from it during the action of pouring, damp sand is used for the under body, as well as for the surface. A study of this point will show that the hard body under the surface only requires sufficient dampness to allow the sand to pack solid and hold the form of vent holes. If a vent wire were passed through a body of dry sand or dust, the hole left by the wire would fill up with sand, just as if the wire passed in and out of a body of water.

Another factor to be considered in connection with the point just raised is that dampening sand has the effect, up to certain limit, of decreasing its density, so that in using the "tempered" or mixed sand, as in the ordinary green sand mold, it must be rammed in order to transform it back to something of the density that exists when the sand is in a dry state. If we dampened the sand to the degree of making a mud, then we again effect a density much nearer to that which exists when the sand is in a dry state. In other words dry sand packs itself in a manner similar to mud; whereas when it is in the state between dust and mud we must ram it to obtain a similar density. I have found by tests that I made for this paper, that a pailful of sieved loose tempered sand can be rammed down about 3 inches while a pail of sieved dry sand will go down by ramming but about 1 inch. The same sand made into mud cannot be depressed or rammed down to any perceptible degree. Then again a pailful of the same sieved dry sand tempered suitable to ram molds will fill the same pail 1½ times, whereas when in a mud state it will equal closely the space taken up with dry sand, when packed as closely as it can be rammed.

Fine and Coarse Grades of Sand.

The grade of sand best to use depends chiefly upon the thickness and design of castings. In small plate work, the lighter the castings the finer the sand should be. There would be less loss of light castings by the use of coarse sands than by fine, where the question of smooth and sharp surfaces is ignored, but this is one of the chief points sought in making light work, hence sands are used as fine

as they can be worked without creating too great a loss in castings by not running full or by "blowing."

Smoothness and sharpness of face in light castings chiefly depend upon the character of sand used. It is surprising to note the difference in smoothness and in sharp, clean full indentations that is produced by different sands.

Coarse grades of sand are necessary for heavy work, chiefly on account of the thicker bodies of metal creating extra gases, which must have a freer exit than fine grades of sand can give. By extra skill and care, fine sands may often be used with the result, as in light castings, of giving smoother surfaces, etc., but in many classes of very heavy castings or complicated light ones, the chances of blowing, scabs and total losses would be so great as to make it unwise to attempt their adoption.

There is a great difference in the physical character of sands. Some localities will produce a character of sand that cannot be found in any other section of the country. The foundry that has the best sand to be found for its work in its own locality, is in luck. There are few things more harassing to molders and management than being compelled to work with inferior sands.

Testing of Degrees in Hardness of Rammed Sand.

The density or hardness that is best for the face and under body of a mold bottom may be said to be due chiefly to the speed of pouring and the head pressure of the metal. Two extreme cases would be found in the making of a bottom for a deep pot with a 36-inch head and an open sand plate with a head of ½ inch, as seen in Figs. 1 and 2. In ramming the bottom A for the pot it must be made very hard or of such a density as would be penetrated ½ inch with a pull of 25 pounds by the hardness testing device seen in Fig. 3 and to be described later on, whereas with the "open sand" plate B, Fig. 2, it required but a pull of 2 pounds to penetrate through the packed surface to the under body of soft sand.

The extremes of hardness required by the molds shown in Figs. 1 and 2 illustrate the wide variation that exists in ordinary practice and show in a measure the delicacy of touch, high skill and sound judgment that founding demands of the man competent to make the great variety of green sand castings that exists in many foundries.

The molder that can change from any one job to another and make perfect castings without making from two to three or more to obtain one good one is worthy the name of artist.

Systematic Plans for Making Bottoms.

Foundries having a large business in different classes of work have, to a greater or less degree, experienced losses in casting and in obtaining imperfect work by reason of unsystematic shop methods and unintelligent working on the part of the molders. These evils should cause us to welcome any means to establish more uniform methods of working. There is no reason why greater uniformity and more system should not exist in the making of mold bottoms. If, in a foundry allowing molders to follow their own ideas, duplicate patterns of fire fronts, for example, were distributed to four different molders, we would most likely find one rolling it over, another one resting it on four corners and tucking it up, another sledging it down into a bed of soft sand and anotner making it on a hard bed. A perfect casting could be produced by either method if made by a careful and skilled molder, but as these are rare, we would more likely not find a perfect casting in the bunch. If, instead of this go-as-you-please plan, each shop would have some established plan that had proved a success for all to follow, there would be a noticeable reduction in bad work. It is not to be expected that all shops would follow like methods, nevertheless much could be done toward uniform practice. This is especially true in the matter of making bottoms or beds and in which there is great need of some standard test of hardness. As a result

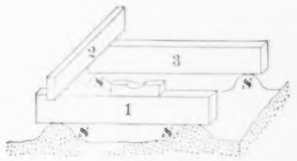


Fig. 5

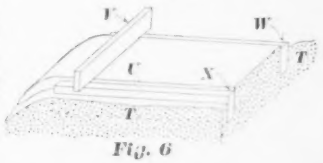


Fig. 6

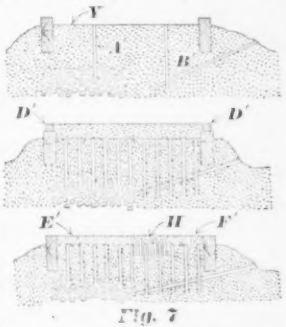


Fig. 7

of my study to offer something new here that would serve for such a test, I present the device seen in Figs. 3 and 4.

By resting this device upon the face of a mold or above it and pulling on the spring balance as seen at D, the compressor or hardness testing rod E is pressed downward into the bed of sand or bottom at F according to its degree of hardness or density, and which is told by the scale of inches at G and the pull on the spring balance. In the device shown the limits are the pressing of the compressor rod D from a fraction of an inch to 6 inches and pulling of the spring balance from one to twenty-five pounds. While the hardness tester is limited to a depth of 6 inches it will be seen that this is sufficient when it is stated that rammed courses rarely exceed this depth.

The sheave wheels H, also the spring balance D, can be purchased in most any hardware store. The compressor rod E should be made of hard wood. The strings K should each be strong enough to lift 40 pounds and kept from getting caught in the compressor rod's guides by little staples as seen at M. The base N, uprights P and top R are all made of pine or other soft wood. The construction need not cost over $2.00. With the above explanation and the two views shown, any one should be able to construct a machine. The ideas presented in this device could be embodied in a machine made after the plan of scales by our scale manufacturers and no doubt this would give a machine better suited for the purpose than the one shown.

The adoption of such a device as shown in Figs. 3 and 4 should afford the management of many foundries a much better control of the molder's work in making beds or bottoms for both light and heavy work than exist at the present day. Take the case of light plate work, stoves as an example, where it is important to hold a uniform weight in duplicate casting. Here we find the difference in molder's ramming, which can vary greatly in hardness, will make some duplicate casting much heavier than others, especially where new men are brought into action. The evils arising from having excessive differ nces in weights need no recital here. Suffice it to say that with a device like Figs. 3 and 4 the management should be able to sustain standards for hardness, so that by the time a new man, or an old one on a new job, had rammed two or three molds he should know how to gauge his ramming to obtain the hardness desired and thus avoid the ramming of 50 or more molds to give undesirable weights, with accompanying losses, before correcting the evil.

In the case of heavy work we would be enabled to fix standards for hardness that would tend to prevent swells, scabs and other evils which are the direct result of lack of uniformity in the hardness of beds. The more one thinks of the advantages to be gained by having some arrangement whereby standards for hardness could be adopted the more he will perceive its value.

Standard Methods for Making Beds.

There are two classes of beds—soft and hard. There is no doubt more difference displayed by molders in doing work in this line than in others, although it is a line which could easily be standardized. To demonstrate the practicability of standardizing the work, I will illustrate plans for making beds (which I have used successfully for many years) in a general manner, avoiding the details in order not to tire the patience of any that may be familiar with such work.

The first work in making a bed after the sand has been tempered is to level the straight edge. This is best done by resting the ends on mounds of sand as at S, and then bring them to a level in the order of Nos. 1, 2 and 3, Fig. 5, after which the space between the mounds S is all filled in and tucked up solidly as shown at T, Fig. 6. In making a soft bed, sand is filled in and struck off to project 3/8 inch to 1/2 inch above the top of the straight edge as seen at U. This done the projecting body U is knocked down all over the bed with the straight edge V to the level of W and X. On this "open sand" castings ranging from 1/2 inch to 1 1/2 inches thick can be made. By having the projection U 3/4 inch high "open sand" castings 2 inches to 3 inches thick can be made on soft beds without the use of a vent wire in any manner. This method insures a definite action, and results in obtaining true castings, but instead of all molders following such plans many are more likely to shovel in their sand to a height of 2 inches to 3 inches above the straight edges, and pound its face down with the flat of a shovel, piece of a board, or with the palm of the hand; methods that are sure to result in lack of uniformity in the face of a bed and hence give imperfect castings.

In making hard beds we must resort more

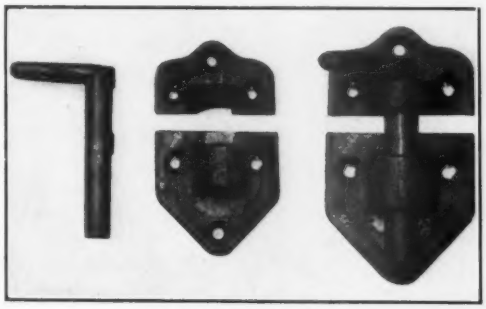
or less to venting, and success in preventing scabs often depends upon the method of venting practiced. A hard bed can be used for open sand casting as well as coped ones, although as a rule they are used only for coped work. A hard bed that will work for "open sand" casting is made by ramming the sand with peen and butt up to the top of the straight edge and striking off the sand within ½ inch to ¾ inch of the top of the straight edges as shown at Y, Fig. 7, and then closely venting all the bed down to cinders as at A′ or to connect the down vents underneath as at B′. After the bed is all vented, the hand is passed over the vent holes to close their top openings and sand is then shoveled on and struck off ¼ inch above the straight edges as seen at D′. This done the guide strips D′ are removed and the projecting sand is then knocked down with a straight edge to the level seen at E′. On this we can cast "open sand" plates from 1 inch to 4 inches or more in thickness. For plates under ¾ inch thick the ½ inch to ¾ inch of compressed sand F′ should be vented with a fine wire as at H to connect with the larger under vents. So much for hard beds for "open sand" castings. In turning to beds for coped work we vary the operation merely by harder ramming of the body Y, varying the distance between Y and the top of the straight edges and also in the thickness of the pieces or thickness D′. By these variations we can obtain any degree of hardness necessary to the work in hand. The contrast to these systematic methods lies in placing go-as-you-please heights of sand, patting it with the hand, tramping it down with the feet or running over the surface with peen and butt, in connection with all styles of careless and unreliable methods of venting, to describe all of which would occupy more than my allotted time.

This paper should demonstrate that there can be systematic methods for making bottoms or beds and in view of the present erratic and bad practices followed in making such, I would suggest some action being taken to have the subject brought before the American Foundrymen's Association with a view to the ultimate adoption by that national body of standards for making beds. This would surely go a long way toward causing our molders to work more systematically, lessen the worry of managers and greatly decrease bad work and losses in our foundries.

A NEW FLASK PIN.

The accompanying half-tone shows two views of a new flask pin which has been brought out by the Economy Manufacturing Co., of Cincinnati, O.

The flask pin proper is cast hollow in order to make it lighter and is provided with two eccentric bosses on the back so that after it has been placed through the openings in the castings upon the flask it can be given a quarter of a turn to tighten. The company furnishes patterns for these flask pins, and it is intended



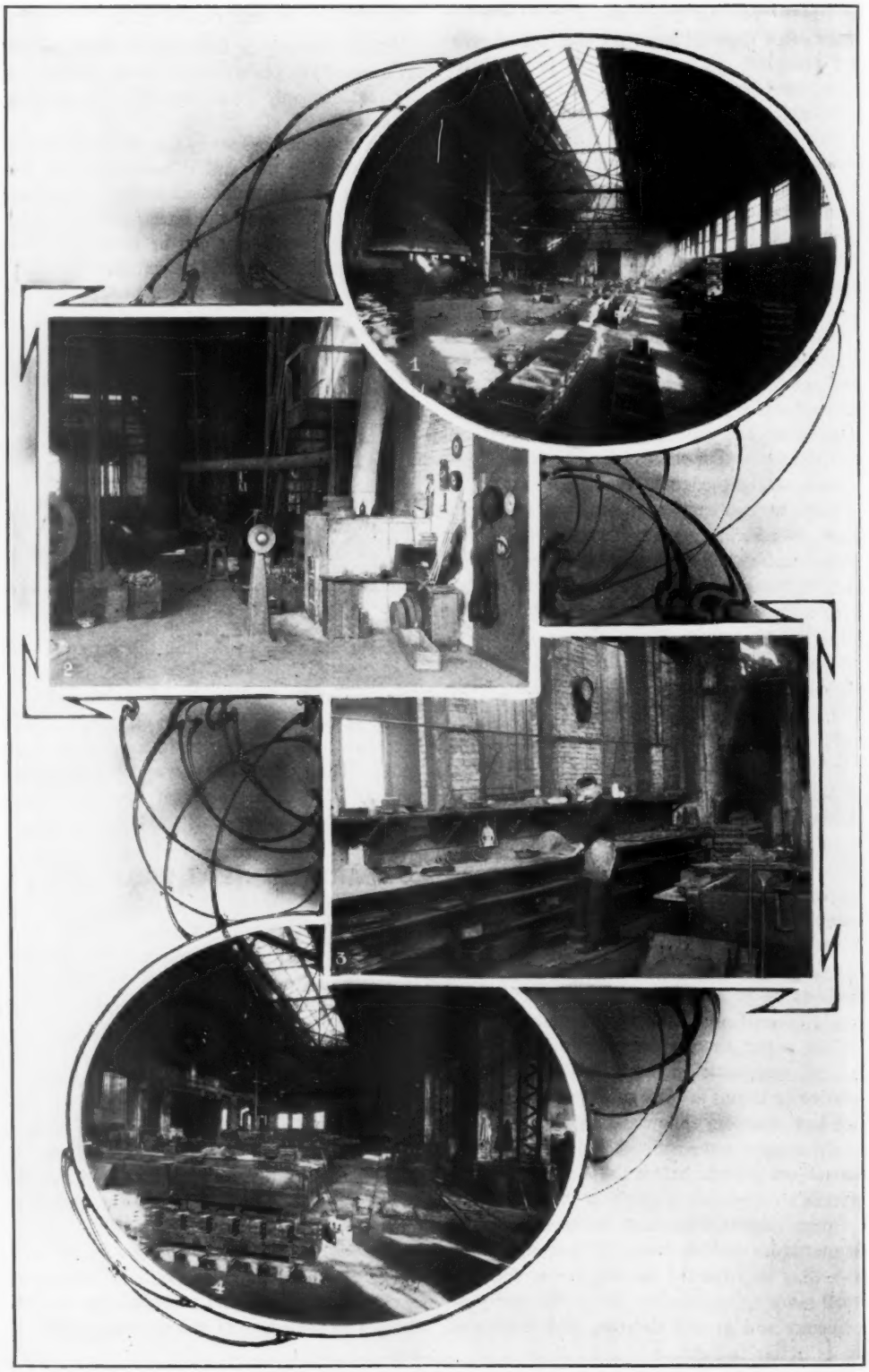
A NEW FLASK PIN.

that the foundry purchasing the patterns shall make their own pins. It is only necessary to have one set of pins to each molder, for as quick as the flasks have been clamped the pins may be removed and used in making the next mold. This scheme does away with projecting pins which will be found of considerable advantage in handling flasks.

IMPROVEMENTS AT SHIRLEY, IND.

The Shirley Radiator & Foundry Co. has located its plant at Shirley, which is a town of about 1800 inhabitants about 30 miles from Indianapolis. In order to make the place more attractive for its employes and encourage them to purchase homes and settle in the region, the company has been interesting itself in improving the town generally. Two months ago it started a public library for the benefit of the people and on Dec. 5 it opened a small opera house for the entertainment of the people. The Indianapolis newsboys' band gave the opening entertainment.

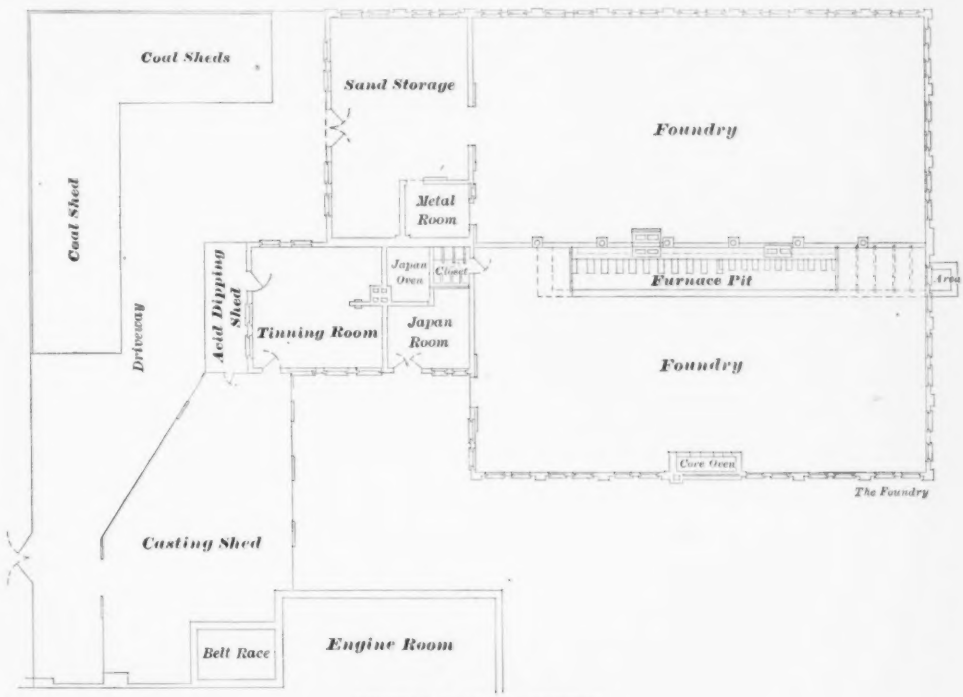
The Southern Foundry Co., of Wilmington, N. C., has increased its capitalization by $40,000. The president of the company is L. D. Baer.



1. MAIN MOLDING FLOOR. 2. CLEANING DEPARTMENT. 3. CORE DEPARTMENT. 4. BENCH MOLDING DEPARTMENT AND CRUCIBLE FURNACES.

Foundry of the National Meter Co., Brooklyn, N. Y.

The National Meter Co. manufactures gas engines and water meters. The iron castings for its gas engines and the larger water meters are made by outside parties, but all the brass and bronze castings are made in its own foundry. Much of its work is of an extremely delicate and intricate nature, especially that used in the smaller water meters. The cores for this class of work require the most skillful class of coremakers and no expense has been spared in getting up the core boxes. The core boxes are made of metal and in many cases are arranged with parts which draw down through the main portion of the core box, using the latter as a stripping plate. For its smaller cores oil sand is used, while for the larger ones the ordinary flour mixture is employed. The company started with a comparatively small foundry and added to it as it became necessary; nevertheless, it has a remarkably well arranged and efficient plant.



GENERAL PLAN OF FOUNDRY.

The plant was first equipped with 24 crucible furnaces, then an Ajax furnace was added. This is a coke melting furnace, having a stationary crucible holding 650 lb. of metal. When the metal is melted, the entire furnace is raised up and tilted for pouring. Later they added a No. 2 Schwartz. At present they are getting an average of 10 heats of 500 lb. each in 10 hours from this furnace, and they have obtained as much as 5,700 lb. of metal from the furnace in a single day. They report that there is no difficulty in melting any ordinary alloy in this style furnace and are using it for practically all their work at present. They use the Ajax furnace for melting down the metals which are to be alloyed with the copper and casting them into ingots for convenience in charging the Schwartz furnace. All special alloys are melted in the crucible furnaces.

When running full handed the foundry employs 85 men. The majority of the work is made by bench molders or upon molding machines. There are, however, a few floor molds required each day and the company has a pit in which it can cast large floor molds if necessary. The foundry is provided with a cement floor and the benches and molding machines are arranged around the outside edge of half of the foundry and across the center of the other half, the core-making benches being

placed along the walls in this half. For handling heavy work a traveling crane is arranged to run on angle irons attached to the lower chords of two of the roof trusses.

The core department is situated in one corner of the foundry and the core oven about the middle of one side. A thoroughly equipped cleaning department is arranged at one end of the foundry; the equipment consists of band saws, gate cutters and emery wheels. One interesting feature is in connection with the removal of the dust from the emery wheels. The exhaust fan removes all of the cuttings from the wheels and deposits them in a casing at one end of the room. A cloth partition prevents the dust from passing out through the ventilating pipe, and in this way a large amount of brass is recovered in the form of fine powder which can be melted down and recovered at small expense.

TINNING DEPARTMENT.

Across one side of the cleaning department there is a bench with a number of vises arranged for the chipping and filing of the larger castings.

Some of the castings require pickling and others tinning. To accommodate this class of work a tinning department equipped with three coke-fired tinning furnaces is arranged next to the core department and adjoining it is the pickling department, where the castings are pickled or colored. Mr. Wm. F. Stoddard is foreman of the foundry.

TURN-TABLE FOUNDATIONS.

Where turn-tables are used for outdoor work in connection with industrial railway equipment there is always a temptation to set the turn-table upon too shallow a foundation, the result being that frost throws them out of line. The turn-tables used in connection with the industrial railway system at the new plant of the B. F. Sturtevant Co., at Hyde Park, Mass., have been placed very carefully to avoid this difficulty. The turn-tables are of a special design manufactured by the company, and each turn-table rests on top of a circular brick well with 8-inch walls extending to the depth of 4 feet or below the frost line. These walls are set upon hard-pan and the center filled with loose stones to provide drainage. One winter's experience has proven that these foundations answer the purpose perfectly.

GIVING IRON AWAY.

BY JOHN H. DE LAMAR.

It occurred to me the other day that many plants manufacturing specialties are giving away a large amount of iron in their castings. Take for instance a large casting which should weigh about 250 lb. If this is to be made in large quantities it will be an advantage to the manufacturer to use a metal pattern and an iron pattern is generally considered the best. If the pattern were made of wood it would necessitate constant repairs which in the course of a year would cost more than an iron pattern. The casting should weigh 250 lb. and the price is set upon it at that weight. As already stated, an iron pattern would be used, and it this were given to the ordinary molder he would rap his pattern in every direction to facilitate removing it from the mold. The pattern being heavy will naturally sink deeper into the sand than a wooden pattern would during this rapping, thus enlarging the mold on all sides and at the bottom. When the castings are weighed we will find that one molder who will not rap as much as another will make a casting weighing 250 lb., while another with excessive rapping will produce a casting weighing 275 lb. or more. The manufacturer does not sell his machine by weight, and, therefore, does not weigh each casting. If he manufactures 100 of these castings and each was increased 25 lb. by rapping he would be giving away 2,500 lb. of iron. When trying to look up the difficulty the rapping is rarely thought of, but the man is liable to think the pattern is too large or too thick, so the pattern is trimmed down and given to another molder. This man is liable to produce a casting pattern size less the shrinkage, which would result in more trouble as the castings are now too small and cannot be finished. This difficulty is likely to be blamed on the pattern-

maker, the real cause being overlooked. Another cause for increased weight in patterns lies in careless pouring. It is possible to pour a mold rapidly and to continue pouring metal into the gate in such a manner as to increase the pressure of metal on the mold to such an extent that the pressure will strain the sand, pressing it back and enlarge the casting. The pattern cannot be drawn without rapping to some extent, but the molder can stop pouring and thus prevent distorting or swelling the mold by forcing an excess of metal in it. The pouring should be stopped when the riser and pouring gates are full. The molder cannot be blamed for making sure that his mold will not be poured short, and therefore the foreman should see that the proper depth of flask is used to prevent extra long down gates, which would swell the castings. The foreman should also see that the runners and risers are large enough to allow the casting to draw metal from this source in cooling. By looking after the matter of shake and the distortion of the mold during the pouring the amount of iron given away can be materially reduced.

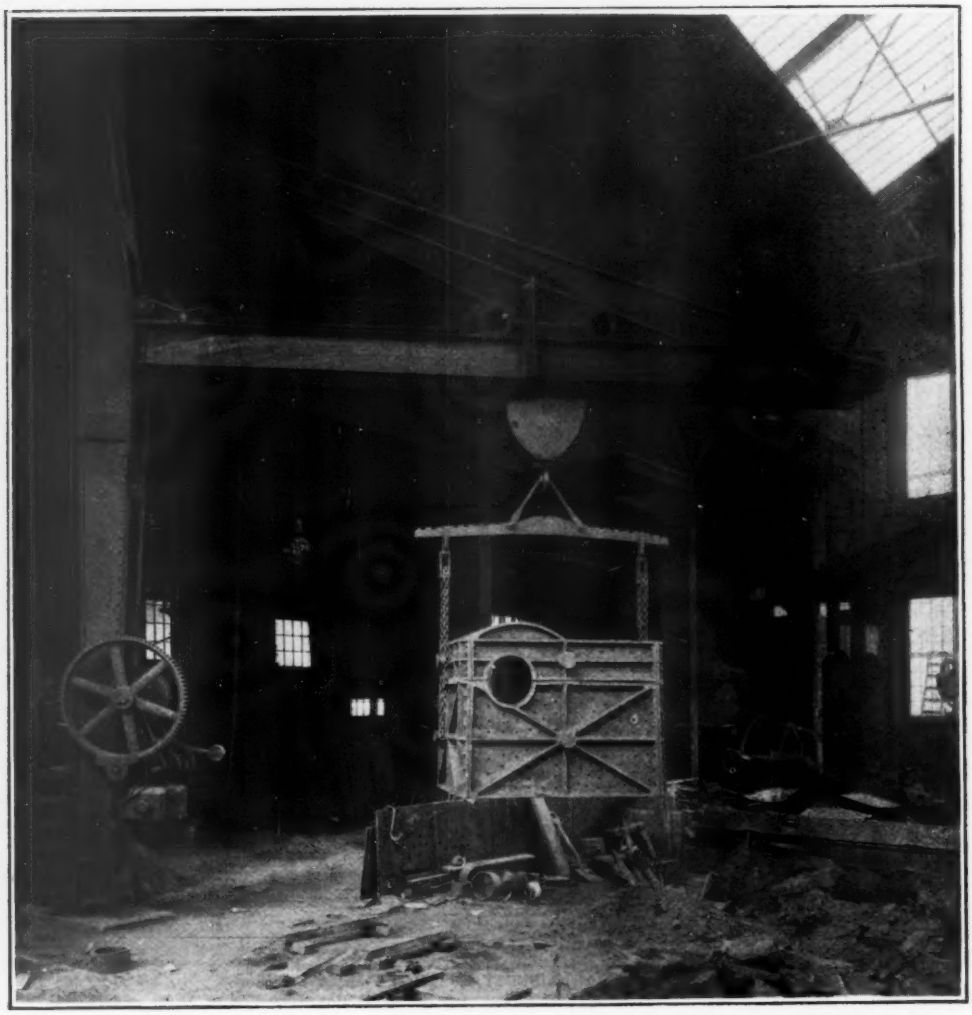
OFFICERS CHICAGO FOUNDRY FOREMEN'S ASSOCIATION.
1. MR. C. E. M'ARTHUR. 2. M. C. O'CONNOR. 3. H. J. HOLMES. 4. JOHN BALKWELL.

Officers Chicago Foundry Foremen's Association.

Last month mention was made of the Chicago Foundry Foremen's Association, and we are very glad to be able to present in this number photographs of the officers of the association. Mr. C. E. McArthur, president, is connected with the Western Electric Co., Mr. C. O'Connor, vice president, is with the Allis-Chalmers Co., H. J. Holmes is with the Brown Manufacturing Co., and John Balkwell, treasurer, is with the Davis & Ludwig Foundry.

A FOUR-TON JIB CRANE.

The accompanying halftone shows a 4-ton jib crane which has been especially designed for foundry use by the Northern Engineering Works, Detroit, Mich., and has a number of features to commend it. These cranes are intended as auxiliaries for use below the regular traveling cranes. Among the features of special note in this crane are the construction of the mast with a straight back so that it can be set close to the column. The drum and sheaves are made extra large for steel wire hoisting rope. The gears are all cut and are provided with gear guards. The hoisting gear is equipped with an automatic brake for holding the load at any point, and permitting it to be lowered either by brake control or by motor as desired. The motor is of the enclosed crane type, especially designed for cranes in foundries. The trolley is fitted with roller bearings of the cage type and the sheaves are bronze bushed. The hook turns on a ball bearing. These cranes are sometimes arranged so as to be lifted from the pintle brackets and transferred from one part of the foundry to another, being carried by the large overhead traveling crane. The hoisting speed can be varied from 10 to 25 feet per minute. The hoisting is done by electric power, but the trolley is traversed by a hand chain.



A FOUR-TON JIB CRANE.

ANNUAL MEETING OF A. S. M. E.

The New York meeting of the American Society of Mechanical Engineers was very successful from several points of view. The attendance reached a total of 826, including members and guests. There was much interest displayed in the meetings, and, as usual, everything moved smoothly under the control of President Dodge.

A new plan was tried in the shape of a name-bearing lapel card. This was a tag giving the member's name and was worn in connection with the numbered badge. The name plate made it unnecessary to consult the printed list and also did away with the inconvenience of trying to find the names of members who had arrived since the list was printed, and hence had higher numbers. The president's address on "The Money Value of Technical Training" was given on Monday evening at the Society House and was very interesting indeed.

On Wednesday morning, Dec 2, the business session was held in the hall of the Mendelssohn Union. Mr. C. W. Hunt and John Kafer gave an account of the progress made with the Carnegie gift for the erection of the Union Engineering building. The committee will prepare for distribution a complete history of the undertaking to date. The land has been secured and a preliminary estimate as to the cost of the building made. It was found that the cost would exceed the amount of the gift, but when told of the fact Mr. Carnegie said the architect's estimate always does exceed the amount, and stated his willingness to increase his gift to an amount sufficient to cover the erection of the building.

The papers presented at this meeting were "Specifications for Steel Castings, Boiler Plates, etc.," which was a report of the committee on specifications, and was given by Prof. Spangler. This paper was discussed by several members. Mr. Frank Richard, of New York, then read a paper entitled "Is Anything the Matter With Piece Work." This paper was quite extensively discussed. Mr. Harrington Emerson presented a written discussion, and most of the others oral.

Mr. H. L. Gantt, of Schenectady, N. Y., presented a paper on "Modifying Systems of Management" and Prof. John E. Sweet a paper entitled "Machine Tools of the Future."

Wednesday afternoon was given up to visiting the electric power stations along the East river. The next session of the society was Thursday morning, and it was held at Stevens Institute of Technology, at Hoboken. Among the papers presented was one by Prof. Jacobus on "Test of a Compound Engine Using Superheated Steam." Mr. F. A. Schaeffler read a paper entitled "Suggestions for Shop Construction." Mr. Carl Barth read a paper entitled "Slide Rules for the Machine Shop as Part of the Taylor System of Management." The papers were all discussed more or less thoroughly, and great interest was shown in the session.

Thursday afternoon Dr. Hans Goldschmidt, of Essen-Ruhr, Germany, gave a very interesting illustrated lecture on "Aluminum Thermics and Their Application to Engineering and Metallurgy." In his experiments he welded rails, burnt a hole through a plate of iron an inch thick, used the heat of the thermit iron for welding pipe, and carried on a number of other interesting experiments, all of which went off smoothly and successfully.

On Thursday evening the annual reception was held in New York and it was a very pleasant affair, where old acquaintances could be renewed and new ones made.

The Friday morning session was held in the Society hall at No. 12 West Thirty-first street. Several papers were read and a resolution prepared by C. W. Hunt, John E. Sweet and John Fritz, as a tribute to the late R. H. Thurston, was read. The meeting adjourned promptly at noon, as many of the members wished to avail themselves of the opportunity to visit the works of the DeLaval Steam Turbine Co.'s shops, at Trenton, N. J. Some 200 members made the trip to Trenton as guests of the DeLaval company. The trip was made by special train, and lunch was served on the train.

The works are extremely interesting, not only on account of the interesting turbines and machines made there, but on account of the good sample of shop architecture and shop management which they furnish.

The Charles A. Lefferts Co., of Brooklyn, N. Y., has been reorganized to do an iron foundry business. Capital, $15,000. Incorporators: C. A. Lefferts, Ida Concanen and John J. Jung.

The Payton Foundry, Madison, Wis., has been sold to a corporation of which N. O. Starks, formerly superintendent of the Fuller & Johnson Co., is a leading member. The concern will be incorporated with a capital of $25,000. The plant will be enlarged and a general foundry business will be carried on.

RECENT PATENTS.

Molding machines: No. 732,918, granted to Louis Berg, of Brooklyn, N. Y., is a novel kind of vibrator machine. It consists of an unbalanced rotary turbine wheel with a motive fluid (air) jet fixed to the bench, table, tub, or machine and having cams on its hub arranged to impart vibrations to the desired object.

J. P. Appleby, of Hopkins, Minn., has improved his patent No. 707,535 which has been described here, the new patent being No. 735,049. The other device related chiefly to the guiding means for the pattern in a stripping plate machine for molding pulleys in which the hub and rim patterns were mounted on the same pattern plate. The improvement includes the old features with the adjustable diamond shaped guide posts, and in addition a device for lifting the flask off the stripping plate when the pattern is lowered.

Some rather peculiar features are represented by the patent No. 735,347 of J. W. Dearsley, of Racine, Wis. It is a stripping plate machine especially designed for setting up molds for straw-cutter feed-rollers of variable length in three-part flasks, although capable of more general use. The patterns for the end flanges, which are shallow and alike except for the runner pattern piece, are put on top of the stripping plate and the two end molds made in the ordinary manner, one being formed with the runner pattern in place and the other without it. Then that pattern is entirely removed and the pattern for the main part of the mold, which has meantime been inside the lower part of the casing, is raised the required distance above the stripper by a novel adjustable means, and the body of the mold formed in the usual manner on stripping plate machines.

E. A. Goepper and V. A. Lloyd, of Louisville, Ky., have made another attempt to do away with the troublesome stripping plate (No. 736,841). The pattern plate is stationary and the patterns are entirely or "solely" supported by it. The flask is normally supported on the pattern plate, but to separate the mold from the pattern the flask is lifted from it by a system of levers and links under the pattern plate, the lifting pins passing through the pattern plate and normally resting under the edges of the flask.

The National Sewing Machine Co., of Belvidere, Ill., has secured two patents (Nos. 726,426 and 731,360) on a molding machine and accessories which are very peculiar in the art. F. W. Hastings is the inventor. The sand is packed by means of a roller, a feature that has not recently been proposed. The roller is supported from a trolley and on the same frame is a strike on each side of the roller. These strikes are pivoted so that the one that precedes the roller acts to scrape off the sand in front of the roller while the other following the roller simply turns back on its pivot and remains inactive as it passes over the surface of the sand. The object of having two strikes is to permit the roller to act in either direction, and to scrape off the sand to the flask on the second passage.

The flask is mounted on a platform which is supported on springs to permit it to yield slightly so that the sand will not be compressed to the full extent on the first passage of the roller, but will have a uniform depth projecting above the top of the flask, which is removed by the other scraper on its passage back. The flask has guides to prevent its moving laterally. A match is used for the first half molded and the second half is mounted on the first half while it is being molded. The two half flasks are provided with bearings at one side so that the upper one can be set on the other easily, the bearings or trunnions being beveled to assist the guiding action. A lifting device for the upper part of the flask is provided. The lifting rods are outside of the frame of the machine and act on the bearings in such a way as to permit the flask to be swung over on the bearing (resting on the lifting rod) after the pattern is cleared.

The Draper Co., of Hopedale, Mass., has added two to its list of recent molding machine patents, Nos. 726,515 and 744,152. The former is another addition to the well known vibrator machine, consisting in the provision of elastic (rubber) supports for the vibrator frame. The other one is one of its series of stripper plate machines, and is especially adapted for use on varied work. The stripper support has downwardly projecting guides for the pattern plate carrier, acting to prevent the lodging of sand on the working parts. The pattern carrier is formed with upturned separated hubs much after the type of the other machines recently patented by the same company.

A notice of the Cooper machine was given in *The Foundry* a couple of years ago. It was described as the most complete and most

thoroughly organized molding machine that had been invented up to that time and it will be remembered that it contained means for measuring and feeding the sand, advancing the parts of the pattern at differential speeds toward the stationary press head to give different compression in different parts of the mold, sprue molding, venting, flask removing and other devices. It has been the basis of a voluminous patent (No. 726,492) recently granted to A. L. and O. Anderson, of Chicago. They have made improvements in nearly every part of the Cooper machine, especially the sand delivering and pattern advancing means, but there is not space here to describe them in detail.

B. B. Carter, of Hinsdale, and F. J. Stratton, of Grossdale, Ill., have invented a new parallel motion stripping machine, No. 727,900. A fluid motor is pivoted on one of the parallel shafts, its piston rod being attached to the end of a crank on the other shaft. Instead of having the cranks on the two shafts extend in the same direction as is usual, they extend from the shafts at an angle so that when one is above the shaft the other is below, and the connecting rod crosses the line between the shafts. It has other features of minor importance.

The Tabor Manufacturing Co. has patented an addition to its vibrator machines (No. 732,276), comprising a wood pattern plate, a metal reinforcing frame mounted on a stationary part of the machine, and an open metal frame rigidly connected with the pattern plate and with the vibrator engine. The use of the wooden pattern carrying plate, which is the main point in the invention, is to reduce cost. W. T. Clark, of Schenectady, is the inventor.

James Mills, of Wilmington, Del., has invented a pressing apparatus for molding (No. 732,576), consisting of a truck running on rails and carrying a standard from which are supported a pressure cylinder and a depending support for the flask. The cylinder hangs from a carriage running on rails on the top of the standard and the flask supports are attached to the carriage also. These flask supports are flexible (chains) for convenience in fixing the flasks. It will be seen that the pressure is not applied to a stationary flask support, but to one that is attached to the cylinder itself, so there will be no tendency for part of the force applied to be used in lifting the cylinder, and all strain will be taken up directly by the pressure device. A double machine is shown, having a pressing device on each side.

The subject of patent No. 741,569, granted to H. G. Voigt, of New Britain, Conn., is a swinging head handpress in which both sections of the flask are rammed at the same time. It is provided with mechanism for separating the sections from each other and freeing the pattern from both, so that it can be drawn out laterally without removing the flasks far apart, so that they may then be easily and quickly brought together again. It is provided with adequate guides, telescoping sprue pin, etc.

W. F. Prince, of Elizabeth, N. J., has secured a patent on a very broad invention (No. 745,293), the broadest claim reading as follows: "In an apparatus for making sand molds, the combination with the flask and pattern and means for moving the pattern into and withdrawing it from the flask, of a stripping plate of wood or similar material described herein as the equivalent of wood, substantially as described." The other claims contain as additional limitations, a wooden pattern, a beveled edge on the stripping plate, the special means for setting the stripper on the frame of the machine, etc. Economy for small amounts of work is the object aimed at. The equivalent material mentioned is "fiber board, composition board, or ebonite, and such materials."

POINTS FOR BRASS FOUNDERS.

FROM A PRACTICAL TRAVELING MAN.

Well, how does Mr. Blank make Wright's yellow castings for 18 cents and pay the molder, helper, other running expenses and have any profit left? With the present prices of metals he must surely be losing. Just how many times this question has been asked is hard to say. Such a man must learn how to mix metals and form combinations to meet the rising exigencies of the times, which according to the prevailing ideas of different mechanics and their theories of friction are numerous.

For example what use is there in using the best grade of phosphorus bronze bearing metal for a slow running grindstone when a sheet of lead or even a pine knot would be just as serviceable? When considerering brass castings the same facts apply, and one should ascertain the actual need and then supply it. A frequent question is, "Can you give us some-

thing cheap?" Yes and no. Some things that are sold cheap are dear at any price; there is a limit. In many cases the brass casting is used only for its anti-rust qualities, acting merely as a figurehead so far as working requirements are concerned. Perhaps this is Mr. Wright's case, and any one who knows how to mix metals to meet these requirements can secure the business and still make a neat profit.

Perhaps the easiest way for a new beginner, who has not mastered the art of mixing metals, is to secure his different compositions from a reliable smelting works until such time as he can acquire knowlege of the different mixtures, and learn how to use scrap, which is an art in itself.

No brass foundry can be profitably run at this date unless old metals are used, and that to a large extent.

Point to be remembered: If you want to be in a position to make Mr. Wright's castings at a profit try this method. A metal to be ductile enough to draw into wire for brass must not contain a great amount of other metal alloyed with the copper. It may be composed of 80 parts copper and 20 parts spelter. From this it will be seen that if a foundryman wishes to make yellow brass castings of 60 to 40 parts copper, and would purchase some old wire cloth, such as is used in paper mills, he could by taking 100 pounds of wire cloth, 40 pounds of copper and 80 parts of spelter (to which he can add 5 pounds of lead if so desired) have enough 60 to 40 mixture to fill a No. 80 crucible and at a cost of production that will enable him to compete with his more successful competitor. This is but one of the many points in the art of using old metals to their fullest profit and advantage.

Kirkwood Oil System for Brass Melting Furnaces.

When a company considers the installation of any melting furnace using crude oil as a fuel, it is immediately confronted by a number of serious problems, as the insurance companies have placed restrictions about the using and handling of crude oil which make it necessary to be very careful as to the style and design of apparatus used for handling it. Tate, Jones & Co., Incorporated, of Pittsburg, have installed their Kirkwood fuel oil, pumping and regulating system in connection with the Schwartz melting furnaces in a number of places. This is illustrated in the accompanying illustration, where the system is shown applied to a Schwartz furnace. The oil is fed to the burners under a carefully regulated constant pressure, and is heated before delivered to the burners. Provision is also made to insure the fact that the oil is free from lumps and foreign substances. The Kirkwood mechanism is absolutely leak proof, thus complying with insurance regulations. The Kirkwood apparatus is shown attached to the furnace. This fuel oil system is in daily use with good results at the H. K. Porter Locomotive Works, Allegheny, Pa., Pittsburg Valve and Fittings Co., Barberton, O., and a number of other plants.

DESULPHURIZING IRON IN THE CUPOLA.

BY C. H. VANNIER.

In April, 1902, an article appeared in the German publication *Stahl und Eisen* giving the results of some experiments in using manganese ore in the cupola as a flux for desulphurizing cast iron.

The tests were made in Austria in a cupola 20 inches in diameter. The coke used carried 11% of ash and .81% sulphur. The pig iron used was of the following analysis:

Silicon	1.930 %
Manganese	.920 %
Sulphur	.006 %

After passing through the cupola without the use of any flux this iron analyzed as follows:

Silicon	2.03 %
Manganese	.72 %
Sulphur	.05 %

Some of the same pig iron was then melted under the same conditions except that 1% of manganese ore and 2% of limestone were added. The manganese ore contained 38.48% oxide of manganese, equivalent to 27.72% of manganese. As a result we are told that sulphur dropped from .05% without the use of manganese ore as flux to .006% with the use of manganese ore as flux.

By increasing the flux to 2% manganese ore and 4% limestone the sulphur is said to have been reduced to a trace in the iron coming from the cupola.

In the same journal, Oct. 15, 1903, there appears further information on this subject, giving results of tests made in Germany during the current year. These tests were carried out in a small cupola taking charges of 1,325

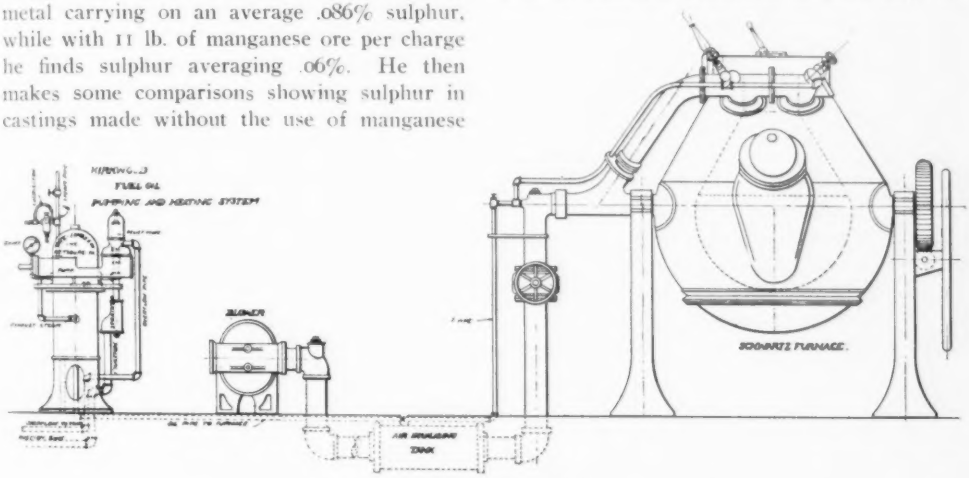
lb. of pig iron, 80 lb. of coke, 11 lb. of manganese ore, and 13 lb. of limestone. The coke used carried 10% ash and 1% sulphur. Manganese ore carried 90% oxide of manganese, equivalent to 60% of manganese.

No analysis is given of the iron used as to sulphur contents; a number of analyses, however, are given of the product coming out of the cupola as well as of the slag; the writer of the article referred to, Prof. F. Wuest, drawing the conclusion that manganese ore is an energetic desulphurizer because he finds less sulphur coming from the cupola when twice the amount of manganese ore was used as flux as when a smaller amount was used; thus with 5½ lb. of manganese ore per charge he gives a number of analyses of resulting metal carrying on an average .086% sulphur, while with 11 lb. of manganese ore per charge he finds sulphur averaging .06%. He then makes some comparisons showing sulphur in castings made without the use of manganese ore as flux, showing that sulphur ranged from a minimum of .06% to a maximum of .273%. However, he gives no analyses of the mixtures used in making these castings, and he also tells us that these castings were gathered together from various outside sources.

To get at the truth in this matter the writer recently made some tests which may be briefly summed up as follows: With the use of 1% of manganese ore carrying 70% oxide of manganese, equivalent to 43% of manganese and 2% of limestone per charge, no beneficial results were found by using the manganese ore as a desulphurizer. The manganese ore referred to was supplied at a cost of $15.00 a ton. By increasing the manganese ore to 2% and the limestone to 4% it was found that the flux had a more energetic action on the lining of the cupola than on the sulphur in the fuel, and the practical result of the test was that the cupola was very much affected without any material reduction of sulphur in the mixture. Several tests were made at different times in different cupolas with the same net result.

Analyses were made of the materials going into the cupola as well as of the iron and slag coming out, and it was found that there was no marked diminution in sulphur in metal coming out nor any material increase in sulphur found in the slag.

It is often stated that limestone, if used in sufficient quantities, is an energetic desulphurizer in the cupola. The writer's experience has been that here also it is a more energetic lining destroyer than desulphurizer, and if used in sufficient quantities to materially reduce the sulphur in the metal it cuts the lining to such an extent as to make its use more harmful than otherwise. The principal use for flux in the cupola is to keep the cupola clean; that is to say, to cut loose from the lining adhering slag and to render these impurities sufficiently fluid so that they can be drawn off through the slag hole in the form of liquid slag.



KIRKWOOD OIL SYSTEM.

Articles of incorporation have been filed by the Anniston Stove Works Co., of Anniston, Ala. The capital stock its $50,000, and the incorporators are: Hugo Graf, of Belleville, Ill.; J. B. Ehrlick, of Indianapolis, Ind.; C. W. Fouches, of Lexington, Ky.; O. W. Snyder, of Lexington, Ky.; Ross Blackmon, of Anniston, Ala. The company will manufacture stoves and ranges. The plant at Lexington, Ky., will be removed to Anniston, Ala.

THE ELECTRIC CLUB JOURNAL.

The Electric Club, which was reorganized on March 19, 1902, by the employes of the Westinghouse Co., have decided to publish the papers read before their club in the form of a journal. The journal will also contain matter of current interest to those engaged in electrical lines. This will not be a trade publication of the Westinghouse Co. The circulation of the journal will not be limited to the membership of the club, but all interested in these lines may subscribe.

The publication address is 735-737 Penn avenue, Wilkinsburg, Pittsburg, Pa.

CALCULATION OF FURNACE CHARGES BY PERCENTAGES.

BY W. E. MUMFORD.

In figuring mixtures for furnace charges, it is sometimes found difficult to arrange a mixture so that the percentage of the chemical elements will be so proportioned as to give an average such as the requirements may demand.

Where pig iron of two or three different grades are wanted in the charge and a certain amount of scrap both foreign and foundry are to be used, the proportioning of these ingredients to give a casting whose composition is to conform to the specifications given by the management or otherwise, is, at first sight, a somewhat complicated problem. The method usually followed is to assume certain weights as being about right and then multiplying these different weights by the analysis of each individual material; adding the products together and then dividing by the total weight of the charge to get the average contents of the mixture.

While this method is perfectly correct it entails considerable changing around of weights with numerous multiplications, and after the nearest mixture is finally decided upon the list of charges is very apt to consist of rather unhandy figures for the weighman to manipulate at the furnace. In cupola practice, where the bed charge is a fixed amount, the calculations must be made separately for it, and should the after charges differ in weight from the bed, a new set of figures must be made. A written record of such a heat appears in pounds only, and should the mixer find his iron too hard or too soft and a change be deemed necessary, he has another long arithmetical problem before him.

It always occurs that certain brands of iron or scrap must in a degree be used in a constant ratio, to meet the conditions of the stock on hand and the probable receipts of similar material in the future, and this is another factor to be constantly borne in mind while compiling a mixture. Only those who have had this work to do can testify to its annoyance, and especially so in gray iron and malleable foundries where different classes of work require different mixtures. This complexity is greatly simplified if the following suggestions are once understood and carefully carried out.

First, make a tabulated record of what material is in the yard, showing distinguishing marks of each pile of iron by car numbers or otherwise, and the analysis as far as can be obtained. I make a practice of tabulating these on a card which is constantly before me when calculating a charge. The following example is based on the percentage of silicon as an illustration:

Brand "a" pig iron silicon.....3.00 %
Brand "b" pig iron silicon.....2.20 %
Brand "c" pig iron silicon.....1.95 %
Brand "d" foreign scrap silicon.....1.75 %
Brand "e" foundry scrap silicon.....1.90 %
Brand "f" steel scrap silicon..... .00 %

Suppose the conditions given the mixer are as follows:

Silicon in casting to range from 1.85% to 1.95%. Loss of silicon in furnace .15%. Total scrap ordered to be used 45% of whole charge, to consist of 10% steel, 15% foundry scrap, and 20% foreign scrap.

As regards the pig iron only a small percentage of brand "c" may be permitted for certain reasons, say 10%. Therefore we have thus far decided upon the following:

10 % Brand "c" pig iron silicon..1.95 %
20 % Foreign scrap "d" silicon..1.75%
15 % Foundry scrap "e" silicon..1.90%
10 % Steel scrap "f" silicon..... .00%

Total 55

Thus leaving 45% to be divided between brands "a" and "b" of pig iron. Now, instead of assuming weights to use in multiplying, let us use the percentages for the same purpose, and we have:

10 % "c" × 1.95 = .195 points
20 % "d" × 1.75 = .350 points
10 % "e" × 1.90 = .285 points
10 % "f" × .00 = .000 points

55 Total.... .830

But as we lose .15% in melting and want a casting of 1.85% silicon to 1.95% silicon, our mixture would have to stand at about 2.05% silicon. Or, in other words, 2.05% — 83% = 1.22% to be divided between "a" silicon, 3.00 and "b" silicon 2.20%. This may require two or three trials, but may be easily perceived after a little practice.

Having concluded that of the remaining 45% of pig iron we will need about 30% of "a" and 15% of "b," let us try our mixture.

30%	"a" ×	3.00%	= .900
15%	"b" ×	2.20%	= .330
10%	"c" ×	1.95%	= .195
20%	"d" ×	1.75%	= .350
15%	"e" ×	1.90%	= .285
10%	"f" ×	.00%	= .000
100 %			= 2.03

From 2.03% deduct .15% for loss of silicon, which leaves 1.88% or within the limit for the casting to analyze. To apply these percentages to obtain the weights, simply multiply the total weight of any particular charge and the results are in pounds. For instance, suppose the charges were 2,000 lb. each, we would have:

2,000 × 30%	brand "a"	= 600 lb.
2,000 × 15%	brand "b"	= 300 lb.
2,000 × 10%	brand "c"	= 200 lb.
2,000 × 20%	brand "d"	= 400 lb.
2,000 × 15%	brand "e"	= 300 lb.
2,000 × 10%	brand "f"	= 200 lb.
		2000

I have purposely used a rather diversified mixture to illustrate how all the ordinary requirements may be considered, and also to show how easy the silicon could be increased or diminished, ad libitum, and at almost a glance by changing the variable percentages from a higher to a lower brand, or vice versa, as the case may be. Should the irons "a" or "b" prove unsuited to the requirements, other brands from the yard could be substituted to meet the conditions.

The advantage of using percentages is most appreciated when charges are made up from the office; and if the table of calculations as illustrated above is kept before the mixer, he can make any alterations he chooses mentally, and avoid all tedious multiplications and divisions. Also, if a car of iron is nearly consumed he can select a substitute from his list of cars at hand, and if the analysis does not exactly agree he can see at once whether his silicon is increased or lessened to any harmful extent. This same method can be used for determining the percentage of all other elements if desired.

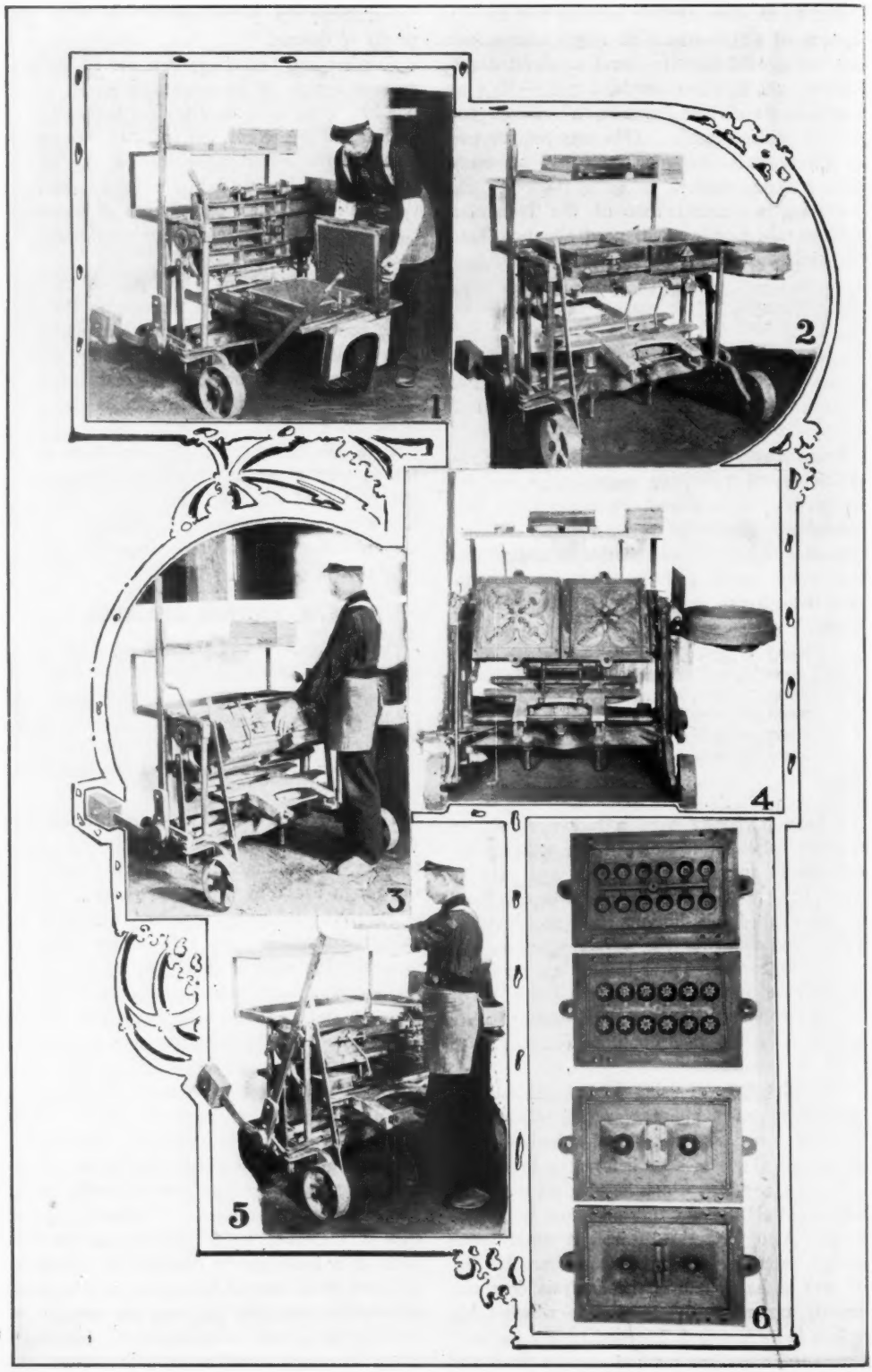
Another and very important use of the percentage system is in computing costs, as all one has to do is to multiply the percentage of each brand by the cost per ton, add these products and the result is the cost per ton of the mixture. In buying iron for future delivery, the relation of their percentages of consumption will lend great aid in proportioning the various brands.

Of course an accurate analysis of the material is indispensable in forecasting the ultimate composition of a casting, and while pig iron producers may give a tolerably correct analysis of their iron it is a great benefit to learn by analysis if the furnace is doing its work as expected. As most modern plants have a laboratory of their own there is no reason why a perfectly uniform product cannot be turned out, and furthermore, the fact that a chemist is known to be employed exerts a good influence upon those sending material into such a plant.

CAR JOURNAL BEARINGS.

A convenient size of crucible for pouring car brasses is a "hundred," which will hold 300 pounds of brass. This will cast from five flasks of the 5½ x 10-inch solid brasses to fifteen flasks of the 4¼ x 8-inch shells, the average number of molds poured at one heat being twelve.

The alloy used should be sufficiently hard to wear well, and at the same time it must possess the strength requisite to withstand the rough usage to which the journal bearing is subjected without breaking. Bearings for passenger coaches and refrigerator cars are generally made of a good quality of bronze. Some companies specify the proportions of the alloy to be used for both brass and babbitt filling and test the castings by analysis, but the majority of car brasses are largely composed of yellow brass. A mixture very often used consists of 50 percent yellow ingots and 50 percent car brass scrap. The yellow ingots are obtained by melting down light-yellow scrap, which produces a much harder metal than a new mixture of copper and zinc, and is therefore beter adapted to the purposes of a bearing. In making the yellow ingots the scrap should be melted in a crucible no smaller than size 300, and the metal must be kept at a low temperature by frequently filling in more scrap as it melts down, the



THE MODERN MOLDING MACHINE.—1. CLOSING THE MOLD. 2. PARTS OF FLASK IN POSITION. 3. TURNING MOLD OVER. 4. PATTERN PLATES TURNED HALF OVER. 5. DRAWING PATTERNS. 6. MATCH PLATES READY FOR MACHINE.

iron and other foreign matter being constantly removed from the top of the liquid metal by means of a long-handled and perforated iron ladle. Each pot will hold from 700 to 800 pounds of metal, which is poured into ingot molds. These yellow ingots have no advantage in price over heavy yellow scrap. After the labor, the loss of metal and the cost of melting are figured the price of the ingots is about the same, but they are more convenient to charge into the pots, and produce a better mixed metal from having been twice melted.

Car brasses are often tested by the sledge. A metal that is difficult to break, and the fracture of which is dense, with a whitish yellow color, is suitable for ordinary bearings. "New" mixtures, made from scrap copper, seldom exhibit these desirable characteristics, as there is apt to be a large amount of oxide present in the alloy. When broken the fracture sometimes shows black patches of flaky dirt, the presence of which often causes honeycombing, or the spots may appear as thin flakes of metal separated from each other by a greenish dust. A second melting, however, will greatly improve such alloys, and for this reason it pays to make the ingots.

A new metal for cheap brasses consists of scrap copper 98, zinc 45, lead 7, scrap car brasses 100 and hard machinery scrap 50.

After the castings are removed from the sand, the gates are broken off and the brasses are tumbled, ground, and, if solid, bored to size and then filled. This is accomplished by swabbing the bored part of the bearing with zinc chloride, which is allowed to dry and then they are "tinned" by dipping into melted solder, tin and lead alloy, after which they are fitted to a form, clamped, and the anti-friction alloy is poured into the space between bearing and form.

Shells do not require boring or tinning, the lining being held in place by retaining strips cast on the upper edges of the bearing. A lining metal commonly used is composed of lead 80 and antimony 20. A cheaper lining may be made of lead 80 and antimony 10. Sometimes pure lead is used. For passenger journal bearings the following is good: Lead 145, tin 40 and antimony 10. Melt and run into ingots for use as a "hardening." For the alloy take 52 pounds of this "hardening" and 145 pounds of lead.—[C. Vickers in American Machinist.

THE MODERN MOLDING MACHINE.

This is the name given to a molding machine developed at the works of the Arcade Mfg. Co., Freeport, Ill. They are now putting the machine on the market. In general it is of the squeezer type, but has a number of interesting features. Two match boards are used, one for forming the cope and the other the drag. These are placed side by side upon a frame supported on trunnions. The two halves of the flask are then adjusted in place, filled, the molding boards placed on them and clamped by means of special clamps. The flask parts are then turned over and the mold pressed by pulling the long lever forward. When drawing the patterns, the molder raps the yoke carrying the match boards with a hammer so as to vibrate the patterns while they are drawn. The machines are so arranged that the clamps are automatically released when the lever is thrown back to draw the patterns. This leaves the two halves of the mold upon a sliding table in the lower part of the machine. This table is then drawn forward, the two parts placed together and the mold removed. It will be noticed that the natural tendency of the mold is down during each operation, thus bringing gravity to the assistance of the molder. It will also be noticed that the match plates form the face of the squeezer.

The Collegeville Foundry & Machine Co., Collegeville, Pa., has been incorporated with a capital of $25,000.

The Uniontown Acme Radiator Co., of Uniontown, Pa., has just established a jobbing foundry and is prepared to make gray iron castings and to do machine work in connection therewith.

The Homestead Valve Manufacturing Co., of Pittsburg, Pa., has just completed an iron foundry which was started on Dec. 7. Both its iron and brass are melted in special furnaces, which it claims produces better castings than can be made from cupola melted iron or crucible melted brass.

Clarence W. Dickerson has been appointed receiver for the Henry McShane Mfg. Co., of Baltimore, Md. The company is the largest manufacturer of chime bells in the country. It also manufactures brass and other metal compounds. It is claimed that the embarrassment of the company is only temporary and that it will soon be able to continue the work and get on its feet once more.

MELTING METHODS.

BY J. F. BUCHANAN.

In the September issue of *The Foundry* an article appeared on "Melting Ratios in Brass Foundries," in which I had occasion to compare the results of various methods of melting gun metal alloys in crucible furnaces with natural and forced draughts, in oil and reverberatory furnaces, and in the cupola, showing the percentage of loss, tensile strength, economy and comparative advantages of the various methods. In the October issue an article appears quoted from *Metal Industry* which deals with "Melting Brass in the Cupola." The first part of the article is very well written from a technical standpoint, but the last part shows ignorance or disregard of the difficulties encountered in melting brass in a cupola. The story of the Connecticut machinery manufacturer who melted a quantity of yellow brass in a cupola and tapped out "a mass of coke and dross," shows very foolish practice and a total lack of knowledge underlying the principles of this class of work. Furthermore, the officials in the railroad shop at Two Harbors, Minn., made a bad mistake when they put 500 pounds of straight gun metal in the cupola and treated it like ordinary pig iron; under such circumstances they could not expect anything better than a beehive casting. Many persons do not understand why brass cannot be melted in the cupola in the same manner that iron is melted. Fortunately, I have had experience in this matter and understand how to handle the cupola so as to obtain the alloy which I wish. When I want to make bronze in any quantity with the aid of a cupola I put the composition in a hot ladle at the spout and tap molten copper on the top thereof. (See). That, and the fact that about half the usual blast pressure is enough comprise the fundamental principles which underlie the melting of straight gun metal or any other brass in a cupola and the production of castings free from blow holes. I do not hold that the use of the cupola in brass melting is a particularly promising field, but when I have a cupola and no other furnace capable of melting the quantity of metal required for an exceptional casting, like the six-ton propeller wheel mentioned in my article of September, I think I am justified in using my judgment and experience to get over the difficulty, especially when I can get such close results in tensile strength as 17.6 to 19.1 tons per square inch and elongation 14 to 16 percent in 10 inches, these being the test results of the same alloy melted in crucibles in the cupola. I expect that some one is ready to say that straight gun metal is worthless unless it is remelted, or unless it contains some remelted metal. In this connection I may say that in the case above cited, the last charge consisted of 400 pounds of ingot gun metal of unimpeachable quality. One ton of copper was tapped from two 36-inch cupolas every 20 minutes, and the proper proportion of tin inserted in the ladle before each tap. In this way the mixture was comparatively uniform and the casting then made is giving satisfactory service.

The melting methods practiced in various foundries are the natural outcome of different and divergent experiences. The iron founder has devised a system of producing fluid iron in the cupola which he considers unapproachable either in economy or in its effect on the ultimate product; that is, the castings. The brass founder has improvised other means of obtaining the same end, while the steel founder has improved on the brass founder's method to suit the conditions most desirable for the making of steel castings. No sane man would for one minute question the purpose of the several methods which have now become traditional. They are based on rational ideas and long experience in the art of reducing respective metals to the proper fluidity required for running into molds and producing perfect castings. Nevertheless, it may happen, as in my own experience, that frequently an interchange of melting methods would be a very convenient way out of the difficulty. For example, I am in a happy position where iron, brass and steel foundries are in operation under one management. Saturday being a short day with us the cupola is not lit, and the molds made on Saturday are cast on Monday. On several occasions it has happened that some repair casting, which was urgently required for Saturday forenoon, turned out bad, and unless it could be made in a few hours serious results would follow from the detention of a ship in port over Sunday. Some people think there is only one way of doing a thing well. I like my dinner well done, but not over-done; I like my castings done well, but not done over, but on some occasions it has been necessary to do them over. In such cases I have avoided the expense of firing up the

cupola by doing the work in the steel foundry. I have already mentioned that the steel founder has improved upon the brass founder's melting practice. His methods are cleaner, no fuel mixes with the metal in the crucibles, he lutes on a lid to exclude the air as much as possible; he fixes his crucible on a firebrick stand instead of on a soft coke bottom, and as the temperature required to melt steel is very much higher than for brass, he provides a stronger draught. From this, it is obvious that the conditions necessary for the production of crucible steel are more favorable for melting a small quantity of cast iron than the system in vogue in the brass foundry. Speedy melting is a necessity for cast iron; indeed, we know thhat soaking is bad for any metal, but it is fatal to cast iron. Having decided in favor of the steel foundry for our breakdown, the next question is how to melt the iron quickly. The following is the manner in which we accomplished this: An empty crucible was put into the furnace and a strong fire was charged round it. In about 50 minutes the crucible was at almost a white heat. With a pair of ingot tongs, a chunk of pig iron was lowered into the crucible and some pieces of machinery scrap placed around it. The lid was placed on top, a fresh fire charged and the furnace cover luted on. In a little over an hour the metal was ready to pour. It had the well known break and appearance of good soft foundry iron and the casting showed the characteristic fracture in the runner. Except in the matter of cost, castings produced in this way would pass with the best made by other methods.

A New Oil Melting Furnace.

Harry D. Harvey, Nos. 5 and 7 West Lombard street, Baltimore, Md., is manufacturing a new melting furnace, which burns crude oil, though it is claimed that gas may be used if so desired. It is also claimed that the furnace can be employed successfully for melting brass, iron or steel. The furnace consists essentially of an iron casing lined with a refractory material, inside of which is supported the crucible; the latter rests on a graphite support and is so situated that the burning gas or oil surrounds all sides of the crucible, but the products of combustion do not come in contact with the metal being melted. A special burner mixes the fuel and air in the proper proportions.

The entire casing is supported by trunnions and when the metal is melted the furnace is tipped and the contents of the crucible poured into a ladle, by which it can be carried to the molds. The manufacturer asserts a very low fuel cost per pound of metal melted, and also claims that the furnace possesses special advantages on account of the fact that the metal is not in contact with the products of combustion. The furnace is said to have melted in actual foundry practice 100 lb. of metal with 1½ gallons of crude oil. Another advantage claimed is that the crucible is always contained within the furnace and is not subjected to as sudden variations of temperature as would be the case if lifted out for pouring; hence the working life will be proportionately increased.

The Smith, Myers & Schnier Co., Cincinnati, whose plant was recently destroyed by fire, informs us that all but office and patterns were destroyed. The company has about half the the regular force at work in another location, and will be back to its old place by Jan. 1, 1904, running full force.

The Tate Mfg. Co., Chicago, Ill., has been incorporated with a capital of $100,000, for the manufacture of machinery. The incorporators are: N. O. Tate, William Prentiss Jr. and Francis O'Shaughnessy.

The branch foundry of the International Harvester Co., at Springfield, O., closed Dec. 10.

The Harvey Foundry & Machine Co., Chicago, Ill., has been incorporated with a capital of $25,000 to manufacture railway supplies. The incorporators are: R. S. Folsom, Dwight Lawrence, and J. R. Philip.

The Bad Axe Foundry Co., of Bad Axe, Mich., has elected the following officers: William Muttart, president; James Wiley, secretary and treasurer.

The Milwaukee Steel Foundry Co., Milwaukee, Wis., has been incorporated with a capital of $10,000. The incorporators are: C. F. Maynard, W. T. Maynard and J. G. Shaw.

The Turner-Armstrong Brass Co., of Port Washington, Wis., has changed its name to the Wisconsin Brass Co.

The Warm Springs Foundry Co., of Salt Lake City, Utah, has been incorporated with a capital of $3,000. A. R. Lundin is president, secretary, treasurer and director. A. G. Lundin, vice president and director; O. A. Lundin, director. The company will operate the A. R. Lundin foundry in Lakeview subdivision, Salt Lake City.

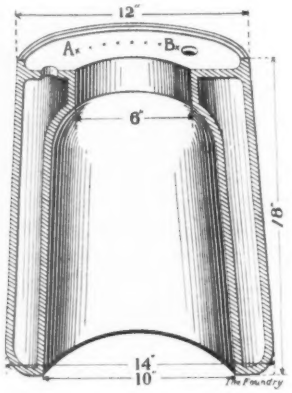
CAST IRON NOTES.

Devoted to inquiries from Practical Foundrymen on the subject of Melting and Using Cast Iron. Address all inquiries to W. J. KEEP, care of The Foundry.

Cracking of Casting.

Question: "We enclose sketch of cross sectional view of a boiler casting which has been giving one foundry considerable trouble for the past month, although it was made for several years without any difficulty.

"The casting cracks on the top from A to B. The analysis of the casting is: Silicon 2.90%, sulphur .09, phosphorus .85, manganese .50. Total carbon 2.75, graphite 2.45.



"The iron is soft and fairly strong and the castings are being made from the same pattern as before, by the same molder, and the same coremaker.

"What do you consider the trouble and its prevention?"

Answer: The iron is too low in total carbon. All other elements are as well proportioned as possible. It seems strange that with a mixture composed mostly of Southern iron the carbon is so low. Southern furnaces are run so fast that the time is too short for the iron to take up as much carbon as if the furnaces were run slower. Northern furnaces are also run very fast, but Northern iron usually contains more than 3.00 percent carbon.

The reason that I object to purchasing iron on a guarantee of silicon and sulphur without reference to the grain is that a furnace may be running so as to give the iron very low carbon with a close grain, in which case the silicon will not be able to exert the influence expected. If the iron has, in addition to the desired silicon and sulphur, an open and dark grain, we may be reasonably certain that the furnace was in good condition and that the total carbon is about 3.25 percent.

I think that a shrinkage test would have shown a high shrinkage in the iron from which this casting was made. If it is inconvenient to change irons at once I would try cutting off the core to thicken the iron when the crack occurs.

Chill of Cast Iron.

This question comes from England: "We make chilled conical bushes for wagon wheels about 12 inches long and 3½ inches diameter at one end and 3 inches at the other, and they are about ⅝ inches to ⅞ inches thick. They are cast on a turned chill. They either come too soft or too hard, as they must be turned on the outside. We hear that you have good chilling irons in the United States."

Answer: It would hardly seem necessary to procure iron from this country, although our charcoal irons would give you a uniform chill. I would advise that you use scrap that shows a good chill in its fracture if you can procure it.

You had better use some method to insure a definite percentage of silicon in your castings, either by chemical analysis or by a shrinkage test.

It is considered that with low silicon and phosphorus and over .50 manganese, you should be able to regulate your chill.

The Use of Scrap in a Mixture.

"Will you answer the following questions concerning the qualities of scrap and pig iron?

"First—Will a mixture of the two make a more durable casting than pure pig iron?

"Second—Will a mixture of the two resist the action of fire better than pure pig?

"Third—Which is more likely to crack from expansion and contraction, pure or mixed?

"Fourth—Are there any stove foundries that to your certain knowledge use pig only?"

Answer: From the last question it would seem that the questioner meant stove castings in all of the questions. Very few large stove foundries purchase any scrap. When only stove castings are made there will be about 40 percent of sprue and discount.

Castings each day—As stove castings must be soft such a mixture will not carry much more scrap.

But all depends upon the percentage of silicon and sulphur in the pig iron and the quality of the coke.

A stove plate mixture should have about 3.00 percent silicon and the sulphur should not exceed .75 percent, but it is very likely to be as high as .90 percent. If the .60 percent of pig iron melted is very open grained with carbon above 3.25 percent and silicon higher than 3 percent, old stove plate may be used instead of pig, the limit being the softness of the castings. Stove castings must have a close even grain. It is better to mix No. 1 and 2 foundry and 1 and 2 soft, if Southern irons are used, and enough Nos. 3 and 4 foundry, with silvery iron to bring up silicon, or old stove scrap may be used instead of the 3 and 4.

The above composition is best suited to withstand the strains that a stove is subjected to.

A first-class stove founder will never purchase scrap if he can get prompt delivery of pig. He makes as much scrap as he can usually take care of.

Strong Castings.

Question: "We make a class of castings from 5-16 inch to ½ inch thick that have no drilling or machine work done on them, so that it is immaterial to us whether the iron is hard or soft; all we require is strength. Will you give us the analysis of a grade of iron giving the greatest strength—that is, the silicon, phosphorus, sulphur and manganese. Also which of these is the greatest element of strength. We prefer to use all of the No. 3 Southern iron that we can on account of its cheapness. Can you suggest the name of some brand of Northern iron that would give us the strongest iron at a minimum cost?"

Answer: Purchase No. 2 soft Southern iron instead of the No. 3, which you can get at the same price as No. 3. It would contain about 2.75 percent silicon.

Use with this all the scrap that it will carry. Use a large part of stove plate scrap.

A mixture of one-half machinery scrap and one-half stove plate scrap would probably make the strongest mixture and you can then add No. 2 soft or No. 3 if you need the iron any softer.

For your work I would not bother much about the composition.

The lower the phosphorus and sulphur the stronger the mixture. Manganese can in your case be anywhere below 2 percent. The higher the silicon the stronger your casting. An all-pig mixture is not nearly as strong as part pig and part scrap.

NEW BOOKS.

"The Factory Manager and Accountant" by Horace L. Arnold, published by *The Engineering Magazine*. As the name implies, the book treats of factory accounting and management. The first two chapters contain a general consideration of the subject. The balance of the book is taken up with a detail description of the system actually used in some of the largest manufacturing concerns in the country, among which may be mentioned the Link Belt Engineering Co., Nicetown, Philadelphia; the Bigelow Co., New Haven, Conn.; C. B. Cotterell & Sons, Westerly, R. I.; the Potter-Johnson Machine Co., Pawtucket, R. I.; the Wells Bros. Co., Greenfield, Mass., and the C. W. Hunt Co., West Brighton, N. Y. In describing these systems the author illustrates the blanks and gives a description of the kind of material upon which they are printed, color of the blanks, color of the ink used, etc., so that any one desiring to install any one of the systems would have no difficulty in reproducing the necessary blanks. The volume contains 432 pages, 6 x 9 inches, is bound in cloth. Price $5.00.

Change Gear Devices, by Oscar E. Perrigo, is the title of a valuable little book published by the Derry-Collard Co., New York. Price of the book is $1.00. It consists of analysis of the gear devices in use and of the change gear patents which have been taken out thus far. It will be found of great value to all machinery builders and to designers in general.

TRADE PUBLICATIONS.

The Hanna Engineering Works, Chicago, Ill., have issued a sheet to be sent out as a folder, illustrating their latest styles of Hanna portable pneumatic screen shakers.

The Buffalo Forge Co., Buffalo, N. Y., has issued two neat circulars, 3⅓ x 6½ inches, describing the Buffalo improved ventilators and Buffalo disc wheels, both of which would be of interest to foundrymen.

The Brighton Alloy Mfg. Co., of Cincinnati, O., has issued a neat folder, stating what the Brighton alloy is.

The Laidlaw-Dunn-Gordon Co., Cincinnati, has issued a catalogue illustrating its new line of air compressors which are equipped with Myer cut-off gear. The catalogue includes a description of these machines and tables, covering their principal dimensions, capacity, etc. This is a new line compressor ranging in capacity from 468 to 2,220 cubic feet of free air

per minute, and for pressures of from 80 to 100 pounds per square inch. The catalogue is entitled Bulletin No. L, 509, and will be sent on request.

Worthington Meters is the title of a little catalogue published by the Henry R. Worthington Co., which describes its disc and piston water meters, also the Worthington hot water meter. The catalogue is made 3½ inches by 6 inches so it will enclose in an ordinary envelope, and is printed on tinted cardboard, thus rendering it durable.

Bulletin No. 136, issued by Dodge & Day, modernizing engineers, of Nicetown, Philadelphia, Pa., is a reprint of a paper which was read before the American Society of Mechanical Engineers by Mr. Day, and which gives an analysis of the Dodge & Day betterment reports.

Bulletin No. 144, by Dodge & Day, modernizing engineers, is an attractive circular describing their betterment reports and giving some details as to the manner in which they would be found useful to the manufacturer. This publication has quite a novel cover, in that it is printed to represent a pile of reports which they have made for various manufacturing concerns.

PERSONALS.

Mr. W. A. Rodell has taken charge of the Kennedy Valve Mfg. Co.'s foundry in Coxsackie, N. Y.

Mr. H. F. J. Porter, who has been associated with the Westinghouse interests since the first of the year as assistant manager of the publication department, has been made second vice president of the Nernst Lamp Co. This appointment does not affect Mr. Porter's relations with the publication department.

Mr. George C. McKee has been appointed chief engineer for the Youngstown Foundry & Machine Co.

DEATHS.

John L. Jerome, formerly treasurer of the Colorado Fuel & Iron Co., was found dead in bed Nov. 22, at his summer home at Buffalo Park, 40 miles from Denver. Death was caused by an overdose of a drug, which he had been in the habit of taking to induce sleep, and was evidently accidental. Mr. Jerome was born at Fabius, N. Y., 49 years ago, and was identified with the Colorado Fuel & Iron Co., for a number of years. He was treasurer when he retired last July.

William Dale Burt, of Pittsburg, died on Nov. 14. He was associated with his father, William H. Burt, in the Enterprise Foundry Co., of Pittsburg. His death is said to be due to heart failure.

George H. Palmer, secretary and treasurer of the Palmer and DeMooy Foundry Co., of Cleveland, died at his home Dec. 7. He was sick but a week and was 43 years of age. Mr. Palmer was born at Oshkosh, Wis., in 1860, but most of his life had been spent in Cleveland, he being one of the founders of the firm of Palmer & DeMooy.

George S. King, founder of the Cambria Iron Works, now the Cambria Steel Co., died Dec. 17, at the home of his daughter, Mrs. J. P. Linton, at Johnstown, Pa. He was in his 95th year.

John W. Miller, who had worked 40 years as a molder at the Eagle Foundry, Indianapolis, Ind., died on Dec. 12. The works were closed so that all the employes could attend the funeral. Despite the fact that Mr. Miller was 75 years old, he worked at the foundry until two weeks before his death, and was able to do as good a day's work as many of the younger men.

FIRES.

Property valued at $30,000 was destroyed at the plant of the Williams Stove Lining Co., at Taunton, Mass., on Nov. 30. The loss is nearly covered by insurance. It is reported that the burned buildings will be rebuilt at once.

The plant of the Reading Radiator Co. at Reading, Pa., was visited by fire on the night of Dec. 5. The elevator shaft leading to the cupola platform and some of the adjoining portions of the building were slightly damaged, but the fire was soon under control.

A fire broke out around the cupola of the Darling Pump Works at Williamsport, Pa., on Nov. 25, and damaged the building slightly before it could be extinguished. Damage about $100.

The Abram Cox Stove Co., of Philadelphia, Pa., was damaged by fire to the extent of $30,000 to $40,000 on Nov. 25.

Upon the night of Dec. 4, fire was discovered at the plant of the Glover Machine Works, Marietta, Ga. Loss is estimated at $10,000.

The Price-Evans Foundry Co., of Chattanooga, Tenn., was damaged by fire on the night of Dec. 5. It is said to be fully covered by insurance.

On the night of Dec. 2, the pattern shop and foundry of the Variety Iron Works in Cleveland were destroyed by fire, and for a time it looked as though there would be a general conflagration in that region. The works of the J. D. Smith Foundry Sup. Co. are next door to the building, and they were slightly damaged. Their greatest loss, however, occurred in the destruction of the power plant of the Variety Iron Works, which furnished power for both plants. The loss of the Variety Iron Works will probably reach $10,000.

The plant of the Eagle Steel Range Co., Shelbyville, Ind., recently built, was destroyed by fire Nov. 13. Loss $10,000; insurance $3,500.

The Frankfort Brass Works, of Frankfort, Ind., were visited by fire on the night of Nov. 30. Fortunately the fire was confined to the part of the foundry in which it broke out, and the greater part of the machinery and patterns were saved. The loss amounted to about $3,000, fully covered by insurance. The plant will be rebuilt and enlarged at once.

The foundry and machine shops of F. E. Came, manufacturer of railway specialties in Montreal, were destroyed by fire on Dec. 9. The damage to the machinery and plant amounted to $25,000.

The foundry of the Story Iron Works, Bozeman, Mont., was damaged by fire to the extent of $1,000, Nov. 12.

NEW CONSTRUCTION.

The American Ship Windless Co., Providence, R. I., recently completed and put into operation a new brick foundry plant for the making of iron castings. The main building, 150 x 105 feet, is lighted with electricity and is equipped with foundry cranes and other modern devices.

The American Brake Shoe & Foundry Co., Mahwah, N. Y., has decided to double the size of its plant before spring. About 500 additional workmen will be employed.

Charles A. Gildemeyer has moved his foundry and machine business from Philadelphia to Minersville, Pa., where the citizens have subscribed $5,000 for the erection of buildings. A three-story machine shop, 75 x 90 feet, is to be erected this winter, and in the spring a foundry of the same dimensions will be built.

Chas. W. Potts, Spring and Fifteenth streets, Philadelphia, will build an addition to his foundry, 54 x 58 feet.

The Champion Blower & Forge Co., Lancaster, Pa., has purchased 3 acres, on which it contemplates the erection of a foundry, 60 x 300 feet. Plans are now being prepared.

Charles Herman & Son have completed the building of a foundry at Sharpsburg, near Pittsburg, and are manufacturing pneumatic jarring molding machines.

The plant of the Wilmington Malleable Iron Co., Wilmington, Del., is nearing completion. The buildings cover about 46 acres, and are fire proof. There are 6 buildings in the group and they are as follows: Foundry, 221 x 460 feet; annealing rooms, 220 x 500 feet; power and boiler house, 50 x 75 feet; fire proof vaults for patterns, 50 x 70 feet; office building, two stories, 40 x 70 feet. It is expected that the plant will begin operations about Jan. 1.

The Terrell Foundry & Machine Co., Terrell, Texas, recently incorporated, is building a foundry and machine plant, which will be one of the best of its kind in Texas. It will be equipped with up to date machinery.

The Wheland Machine Works, of Chattanooga, Tenn., have commenced work on improvements for their plant, which will greatly increase their output. A new brick foundry, 110 x 200 feet, is to be built. The central bay of the foundry will be 50 feet wide and will be equipped with a 15-ton electric traveling crane. The cupolas will be 60 and 72 inches in diameter, respectively.

The Strow & Patchell Machine & Foundry Co., Charleston W. Va., has had plans prepared for a new foundry. The company will do a general repair business, making a specialty of rebuilding locomotives. The officers are: D. H. Patchell, president; Moses W. Donnally, secretary; H. Morris Jr., treasurer; H. S. Strow, general manager.

The plans for a new foundry and malleable iron works to be erected by the United States Malleable Iron Co., at Toledo, O., have been received, and bids for the construction of the plant submitted.

The Macbeth Iron Works, Cleveland, O., are rebuilding their foundry which was destroyed by fire a short time ago. They are installing a new equipment, including a large traveling crane. The improvements will double their capacity and enable them to handle castings up to 50,000 pounds.

It is stated that the N. & W. Co. will build a large foundry in connection with its roundhouse and repair shops at East Portsmouth.

O. The foundry is to be built some time in the spring.

The National Steel Casting Co., Cleveland, recently organized to take over the plant of the American Foundry & Machine Co., at Ravenna, O., is having plans prepared for making alterations in its plant, so that steel can be manufactured by a special process. The company expects to have the plant in operation in about three months.

The Colcan Mfg. Co., Peoria, Ill., has built a foundry, 50 x 120 feet, and a pattern shop, 20 x 50 feet, both two stories high, with an expenditure of $25,000.

It is stated that the J. E. Porter Co., of Ottawa, Ill., will erect a foundry of fire proof construction, 60 x 160 feet.

The Marinette Iron Works Mfg. Co., informs us that its new plant at Chicago Heights, Ill., heretofore mentioned, will have about three times the capacity of its present works. The buildings and plant will be modern in all appointments, and will consist of the following buildings: One machine shop, 60 x 150 feet; one machine shop, 100 x 250 feet; foundry, 100 x 200 feet; blacksmith shop, 40 x 60 feet; pattern shop, 40 x 50 feet; pattern store house, 40 x 50 feet; power house, 40 x 60 feet; and several smaller buildings for storage purposes, etc. The entire plant is of brick and stone construction.

The Hampden Stove & Range Co. has purchased land near Hampden, Mo., and will erect a $20,000 plant for the manufacture of stoves. The capital stock of the company is $100,000.

The Walter A. Zelnicker Supply Co., St. Louis, Mo., will build a plant for the manufacture of hardware specialties, heavy hardware and repair engines and cars.

The plant of the Iowa Malleable Iron Works, Fairfield, Ia., will be in operation about Feb. 1. It will turn out about 2,500 tons of malleable iron per year. The company is incorporated with $65,000 capital stock. The citizens of Fairfield gave a bonus of $75,000.

The Box Car Loader Co., of Ottumwa, Ia., is about to erect a new foundry 45 x 81 feet.

GENERAL INDUSTRIAL NOTES.

The Nashua Iron & Brass Foundry of Nashua, N. H., has been sold to James H. Toller & Co., of that city.

The Mattoon Stove Foundry, Mattoon, Ill., expects to have its new plant in operation in the near future.

The name of the Duluth Dredge & Dock Co., Duluth, Minn., has been changed to the Marine Iron Co., which concern has filed articles of incorporation wtih a capital of $50,000. The company will repair marine, stationary and gasoline engines, and may build a foundry in the spring.

The Locomotive & Machinery Co., Montreal, Can., has obtained from the Dominion Government authority to increase its capital from $1,000,000 to $3,000,000. The company intends to extend the works at Longue Pointe.

The Record Foundry & Machine Co., Moncton, New Brunswick, has decided to establish works in Montreal. The business in Montreal has thus far been carried on through an agency, but the company realizes that if it is to compete for the Quebec and Ontario trade and the Western markets, it will be necessary to have a plant at Montreal. It has secured a tract of land with unusually good shipping facilities by steamship, canal boat and train. The ground secured was formerly owned by the Malleable Iron Co., and the Sparham Fireproof Roofing Cement Co.

The Powers Machinery Co., of Clarinda, Ia., expects to begin work on its new plant at once. It will carry on a general foundry business.

The Duffy-Trowbridge Mfg. Co., Hannibal, Mo., has re-elected the following officers: President, C. H. Trowbridge; vice president, C. A. Trowbridge; secretary and treasurer, W. F. Chamberlain.

The Currey Mfg. Co., Enid, Oklahoma, has been incorporated with a capital of $50,000. The incorporators are: E. P. Currey, H. H. Watkins, G. D. Orner and J. F. Curran, all of Enid.

The Crescent Foundry, Pueblo, Colo., has commenced operation under the management of E. J. Moulds.

The Elliott-Nichols Foundry Co., Denver, Colo., capital stock $15,000, has been incorporated. The directors are: C. D. Elliott, J. D. Nichols and D. E. Gritman.

Altnow & Ollig have decided to locate a foundry at Red Lake Falls, Minn., negotiating the Great Northern for a lease of ground. The plant will be removed from Winthrop, Minn.

The Milwaukee Steel Foundry Co., Milwaukee, Wis., has been incorporated with a capital of $10,000. The incorporators are: C. F. Maynard, W. T. Maynard and J. G. Shaw.